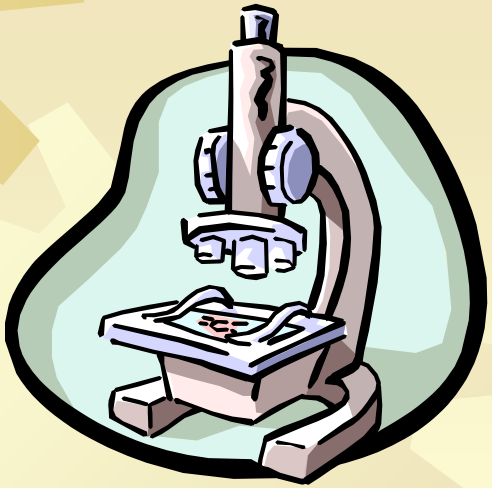
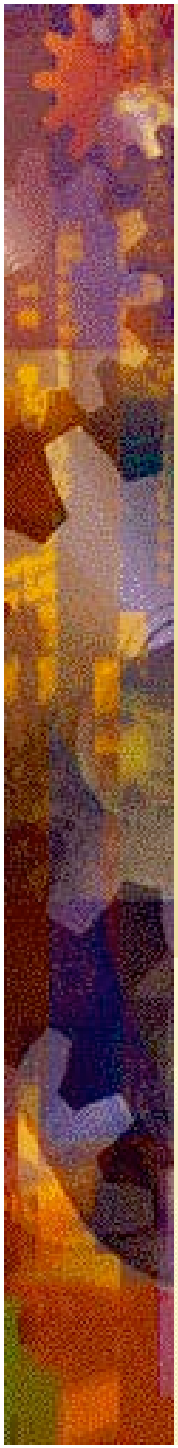


Chemistry & Material Science Ergonomic Briefing

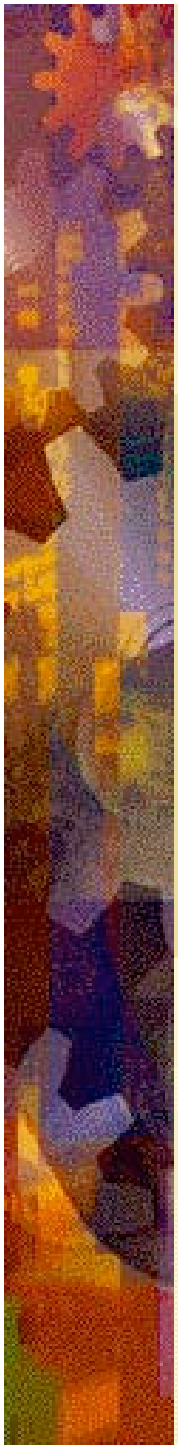
B235



Introduction

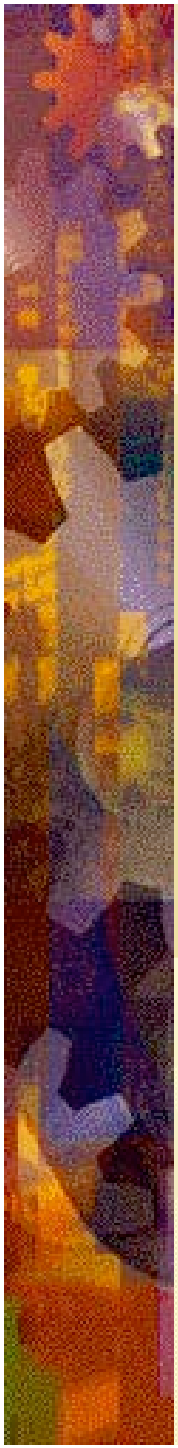
The purpose of this class is to:

- Help you understand good ergonomics and teach you how to apply it to your job
- Be aware of the risk factors for work-related musculoskeletal injuries and how to minimize them
- Offer some self-help guidelines



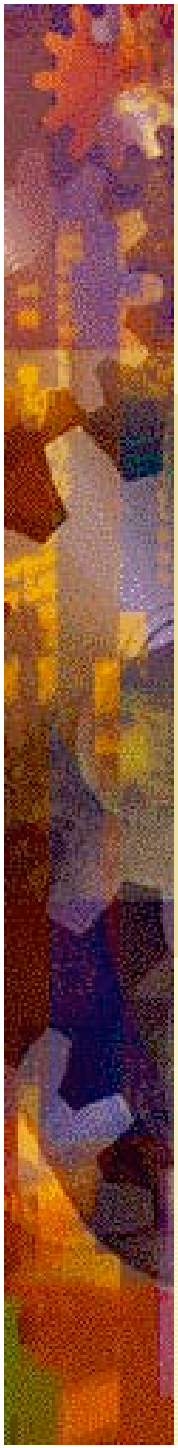
Who We Are
What We Do

- Ergonomic Team Members – Safety Engineer, Physical Therapist, Registered Nurse, Hazards Control
- Address numerous work-related risk factors
- Offer quick fixes/simple solutions
- Educate in good posture and body mechanics
- Offer resources – Demo Room, product information, stretches, ergonomic packet, educational tool



Outline

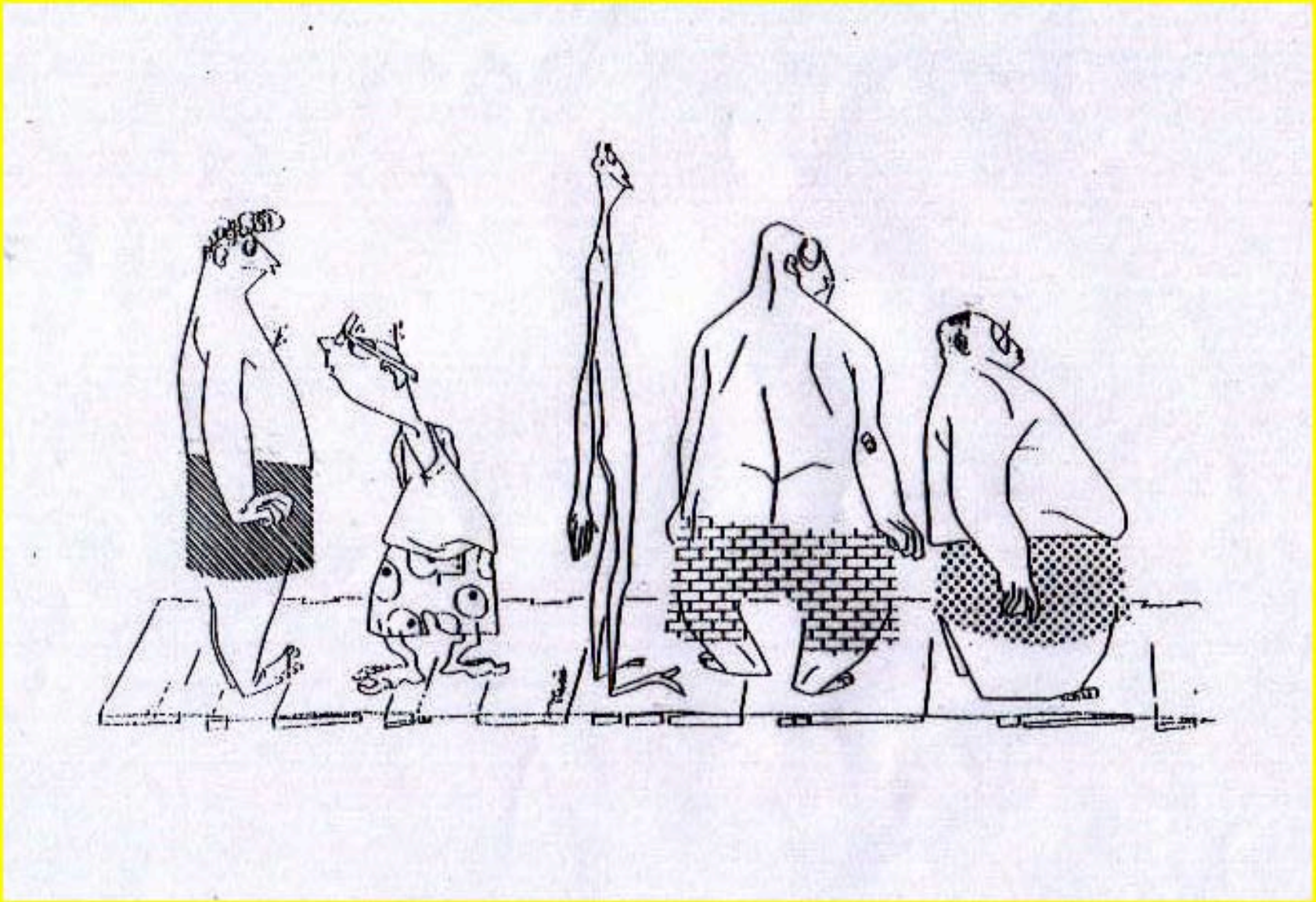
- Ergonomics
- Basic anatomy
- Repetitive motion injury and risk factors
- Posture and body mechanics
- Corrective actions
- Apply what we have learned to your work stations

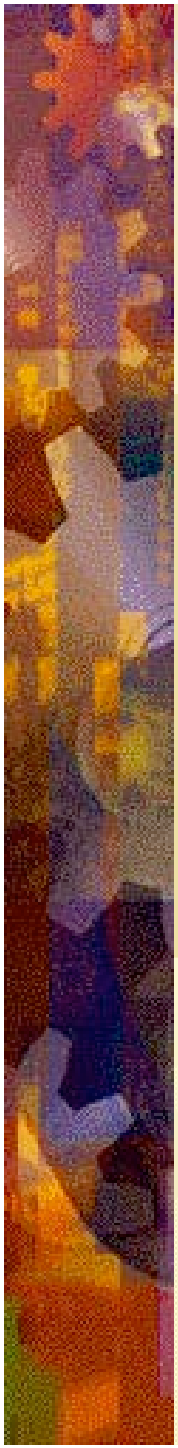


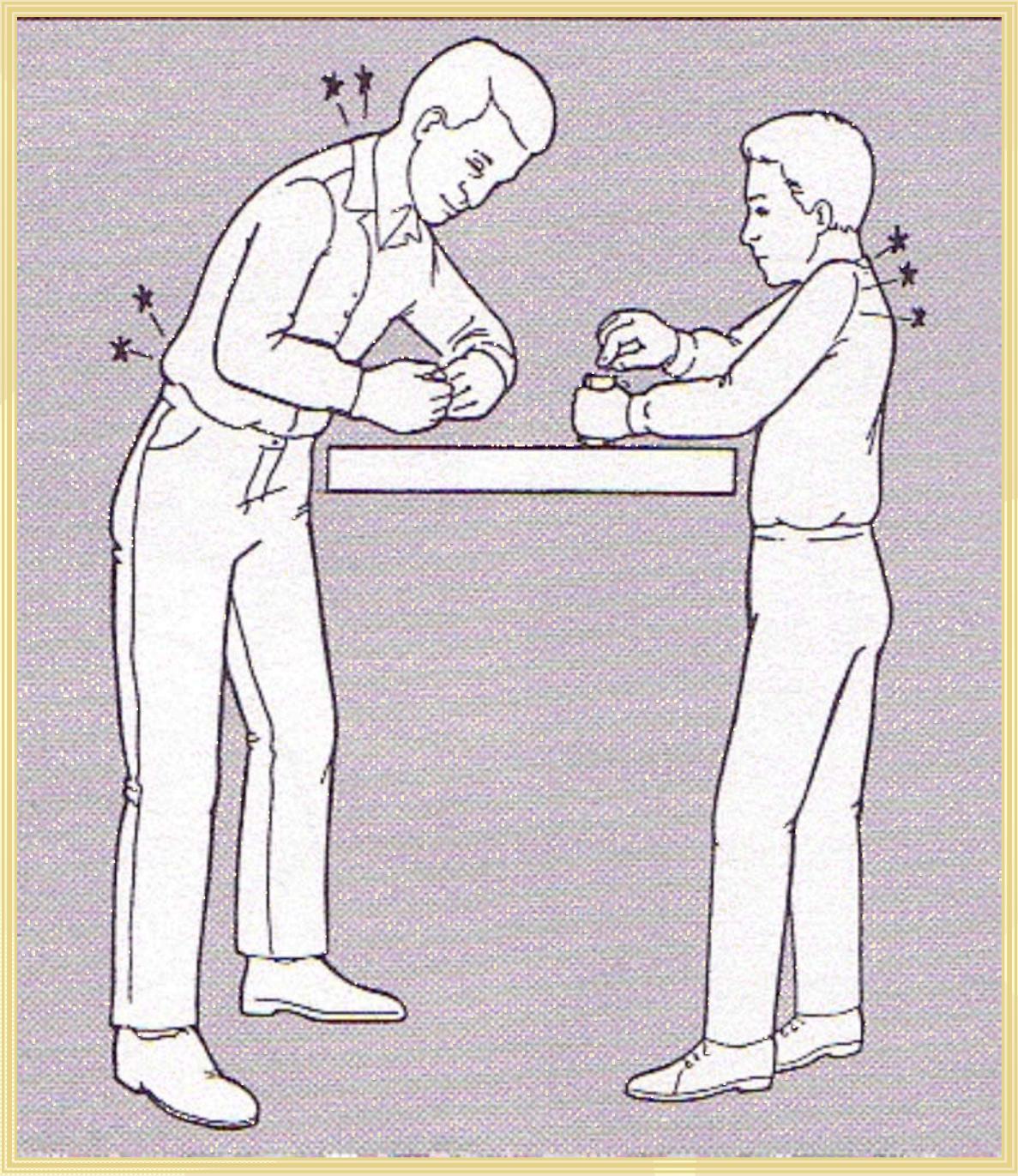
Ergonomics

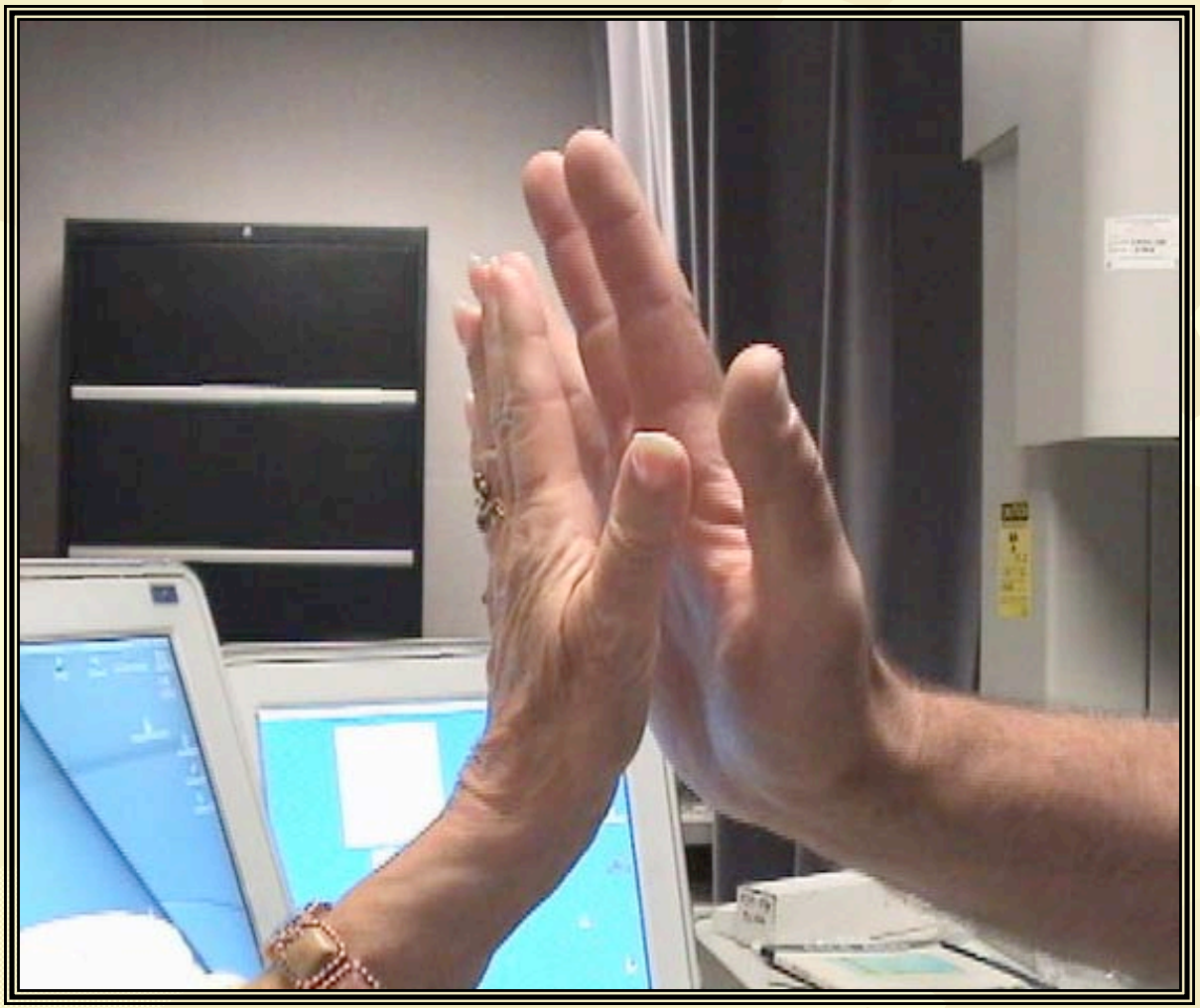
- Defined as the scientific study of the relationship between man, work and the environment.

  "Adapting the workstation to the worker"
- Goal is to design jobs, equipment, the environment and products to within the capabilities of **most** people.









Trauma Bucket

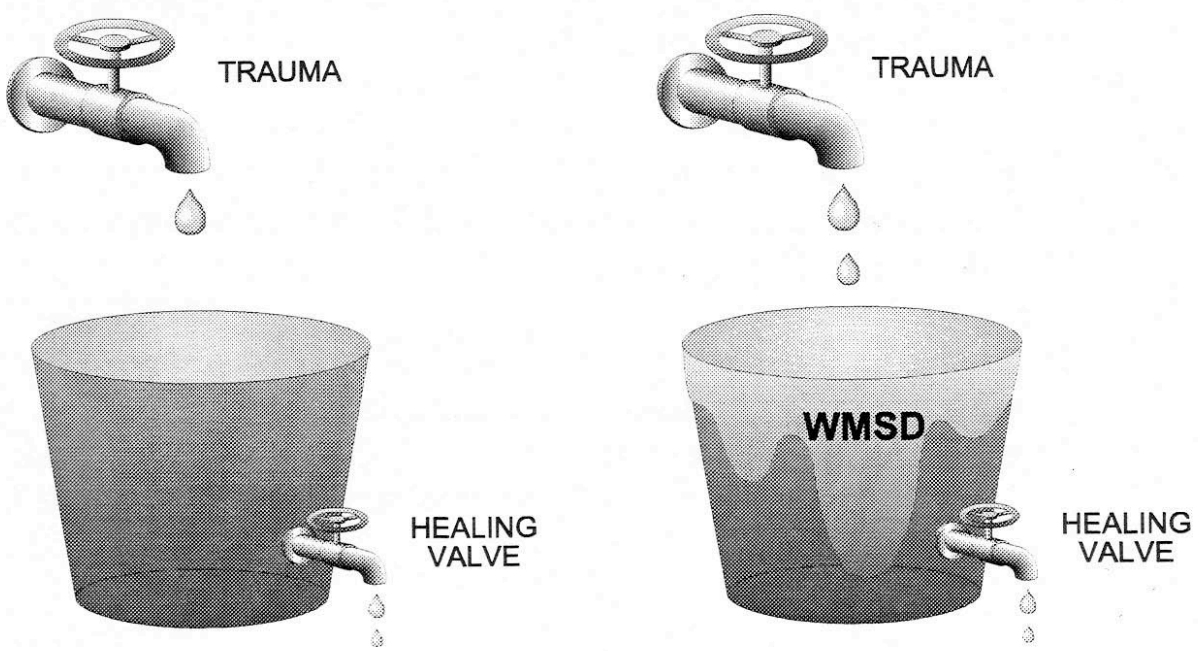
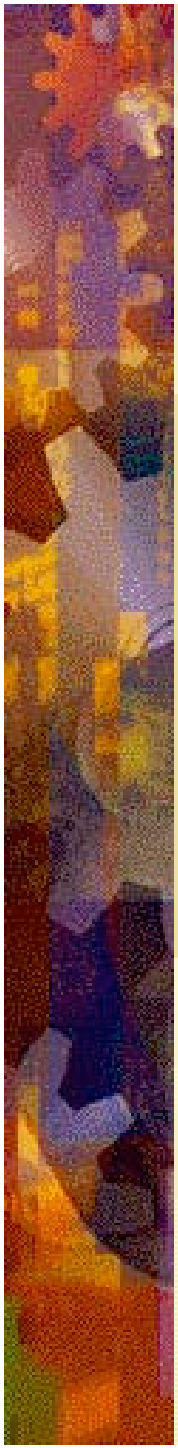


Figure 2.5 The Trauma Bucket

*WMSD – work-related musculoskeletal disease



Risk Factors Observed

- Contact stress – elbows, forearms, and thighs
- Pinch grip
- Poor posture – neck, back, arm positions with computer and microscope use
- Body mechanics need improvement – lifting, push/pull
- Prolonged standing – lack of anti-fatigue mats

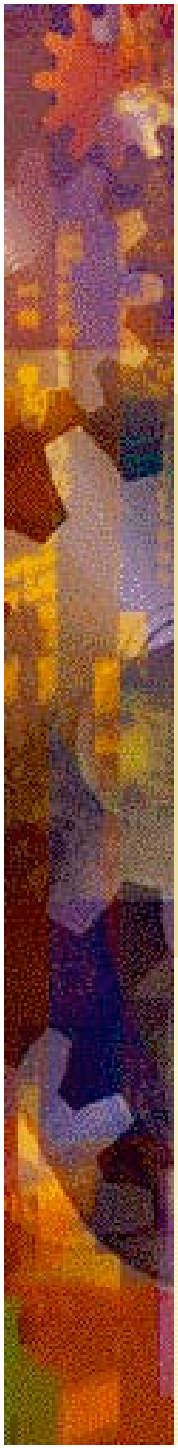
Risk Factors

Repetition

Position/Posture

Force

Time

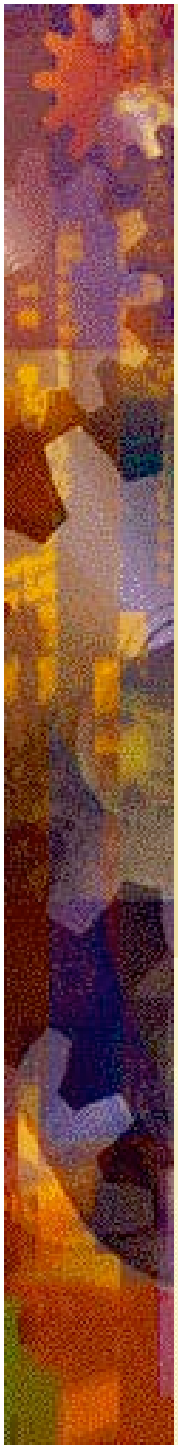


Repetition

- Friction between tendons and nerves
- Fatigue
- Wear and Tear
- Inflammation

Force

- Weight of an object – affects lifting
- Push/pull efforts
- Hand/arm effort (plunger on a pipette, capping vials, grasping a tool, pinch grip, striking keys)



Repetitive Motion Injuries

Repetitive motion injuries are injuries which occur over time with repeated performance of the same task.

This causes stress or microtrauma to body structures including bones, muscles, tendons, nerves, ligaments and blood vessels.

Other Names: RSI, WRMSD, CTD

Position/Posture

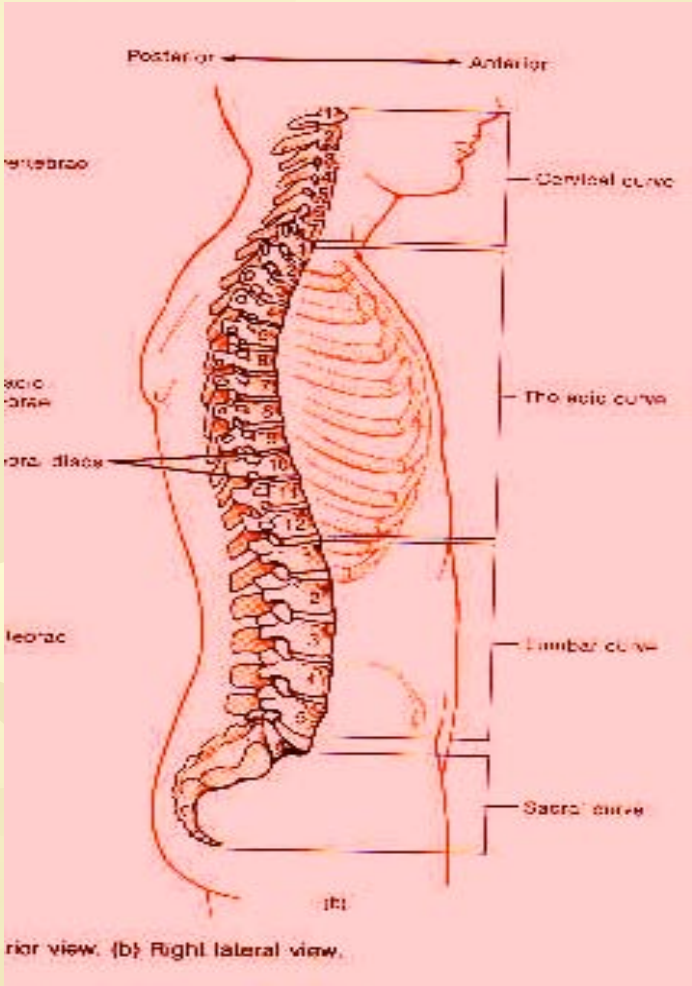
- Muscle imbalance
  - Fatigue
  - Over-stretched/Contracted
- Compression and Stress
  - Nerves
  - Muscles and Tendons
  - Joints
  - Blood supply

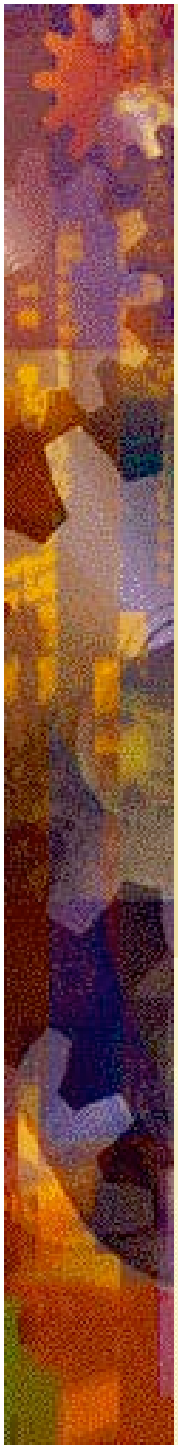
Time/No Breaks

- Constant stress – physical and psychological
- No recovery time to repair microtrauma
- BREAKS are the single most important factor to combat RMI
- Break 1-2 minutes every 30-60 minutes, or vary tasks

Anatomy of the Spine

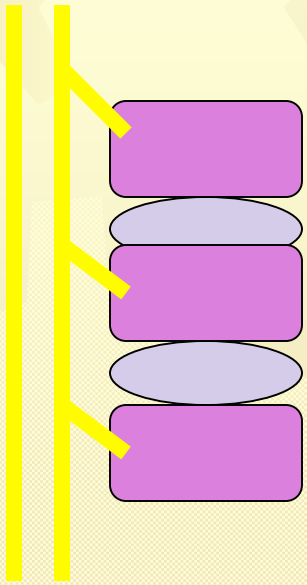
- Bones
- Discs
- Ligaments
- Nerves
- Muscles
- Blood vessels
- S-shaped



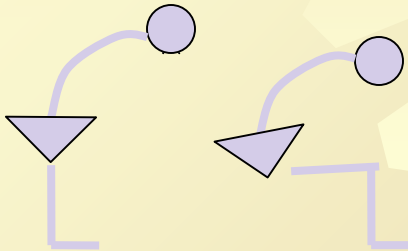


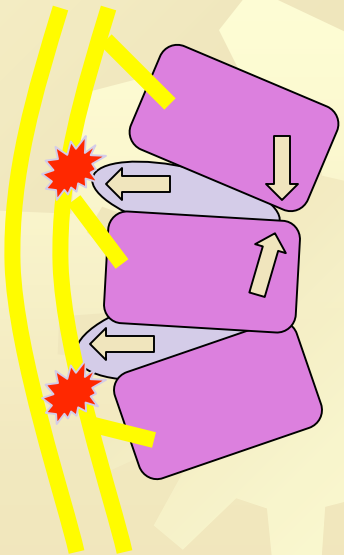
The Effects of Bending on the Spine

Basic Anatomy (Straight Spine)

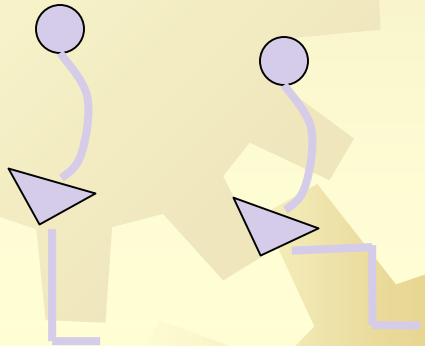


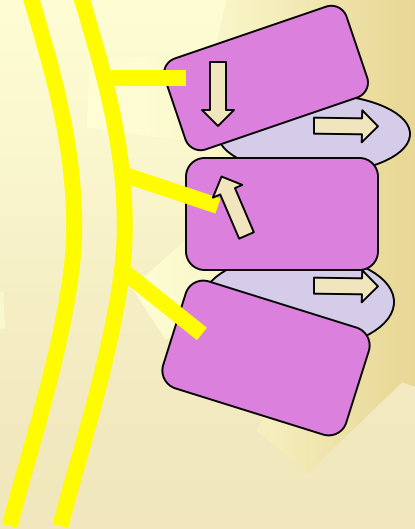
Forward Bend (Flexion)



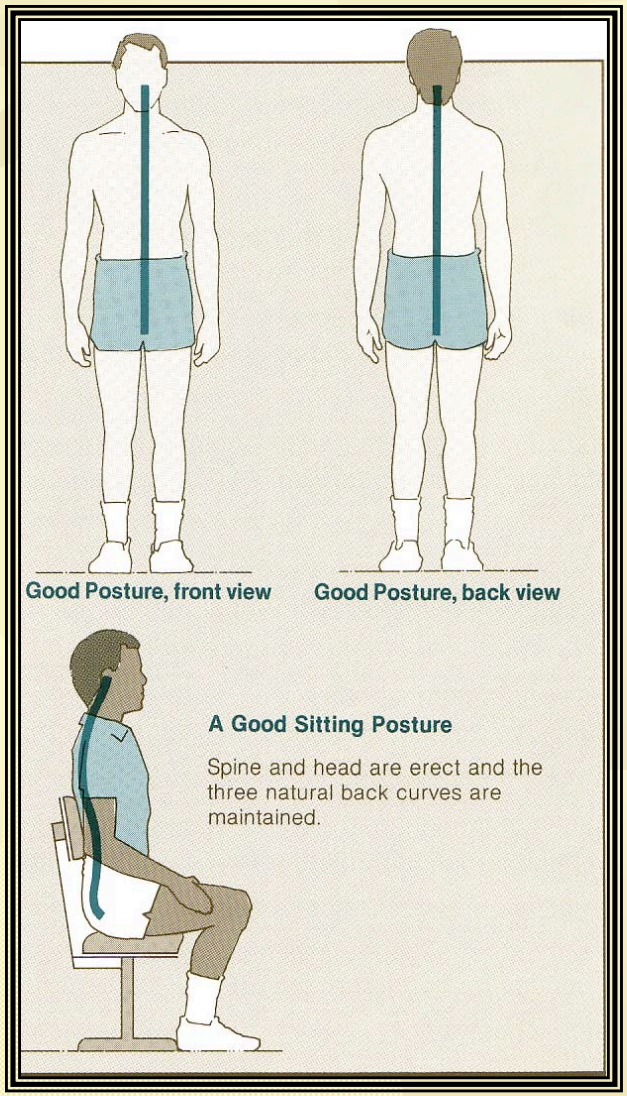


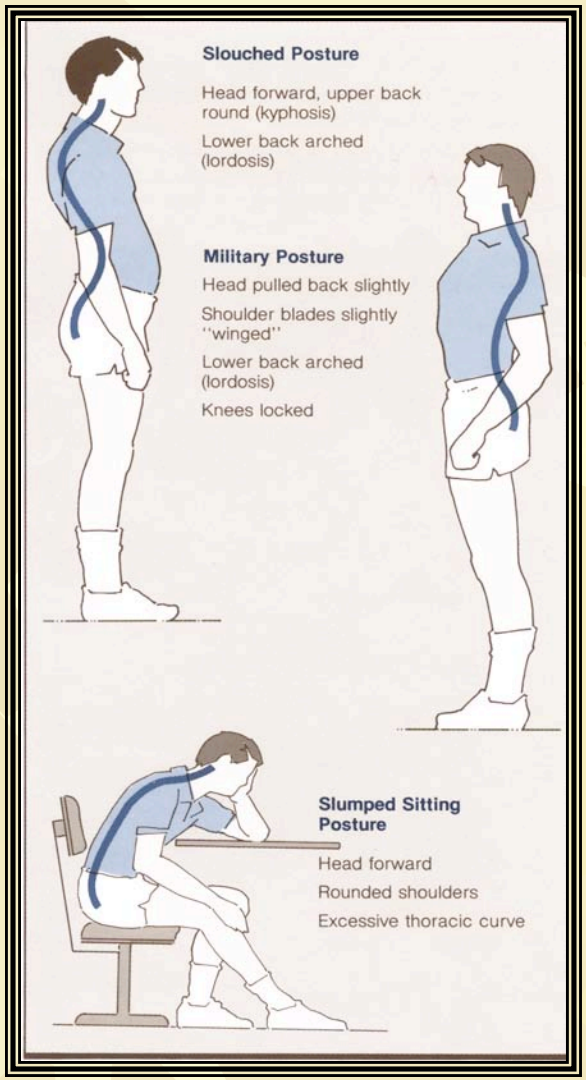
Backward Bend (Extension)





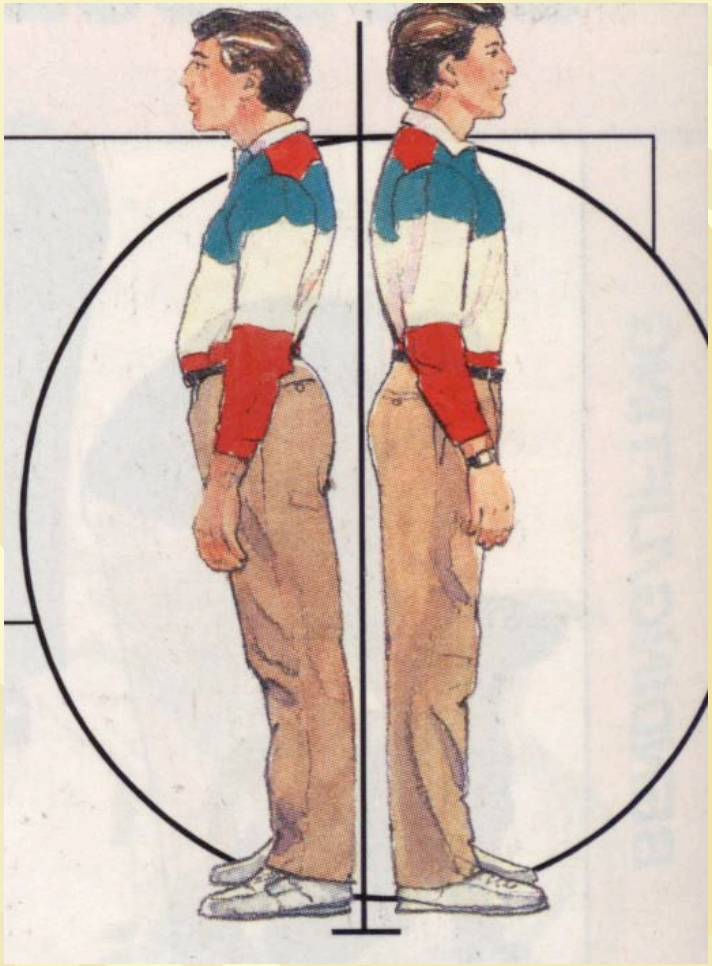
Good and Bad Postures

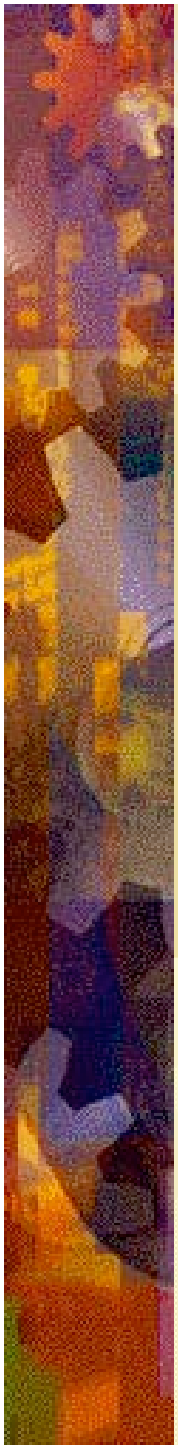




Basic Standing Posture

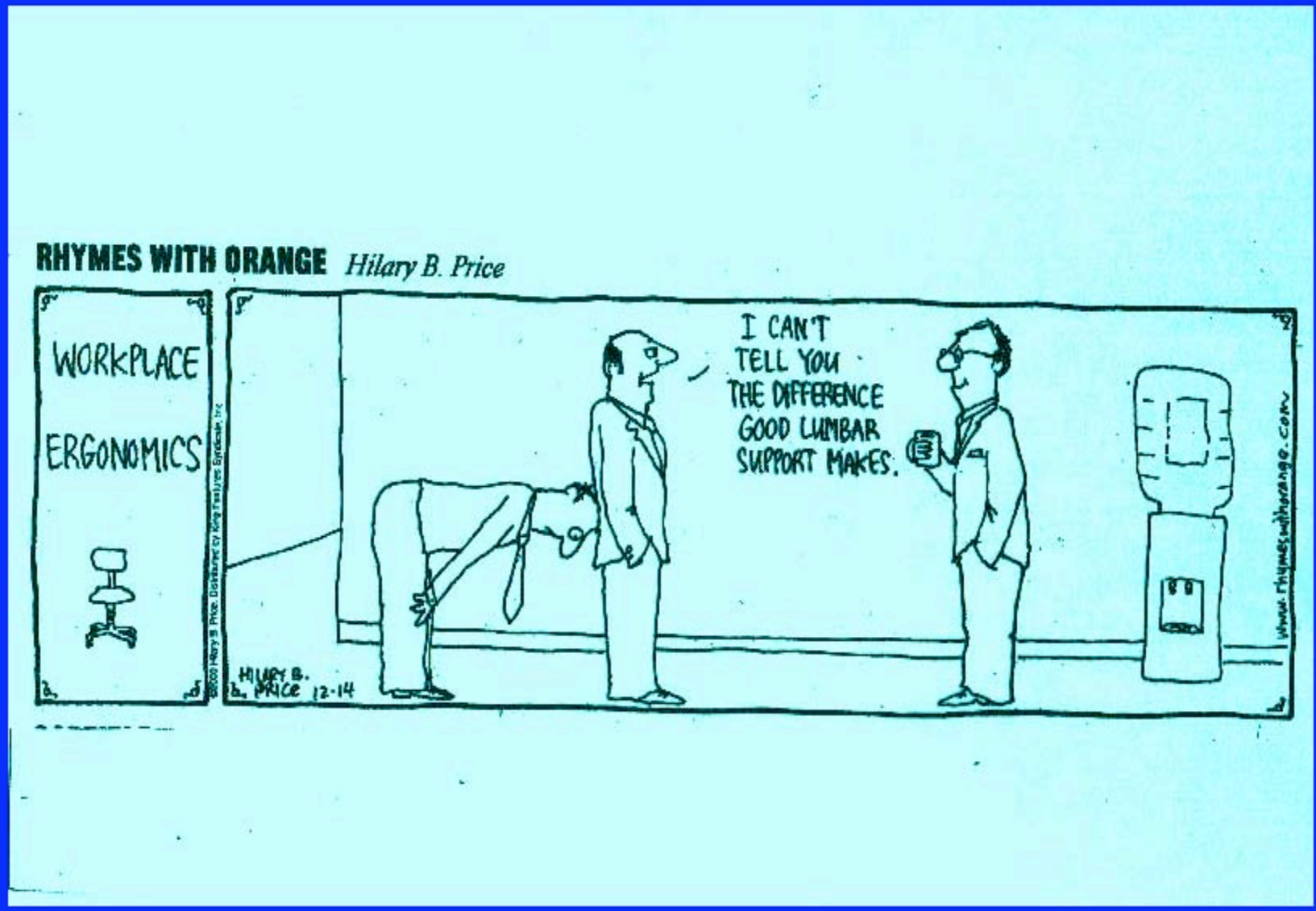
- Ears in line with shoulders, hips, knees and ankles
- Upright but not military stance
- Maintain S-curve
- Knees relaxed
- Legs about shoulder width apart





Sitting Posture

- Ears in line with shoulders; with comfortable chin tuck
- Work positioned where eyes can view work with neck in a straight or neutral position
- Avoid frequent and/or prolonged forward, side or backward neck bending & rotation
- Ears over Shoulders over Hips
- Adequate Chair Height/ Leg Support
- Good Back Support
- Good Arm Support
- Good Leg Support - Adequate Seat Pan Length
- Avoid Contact Stress – thighs, elbows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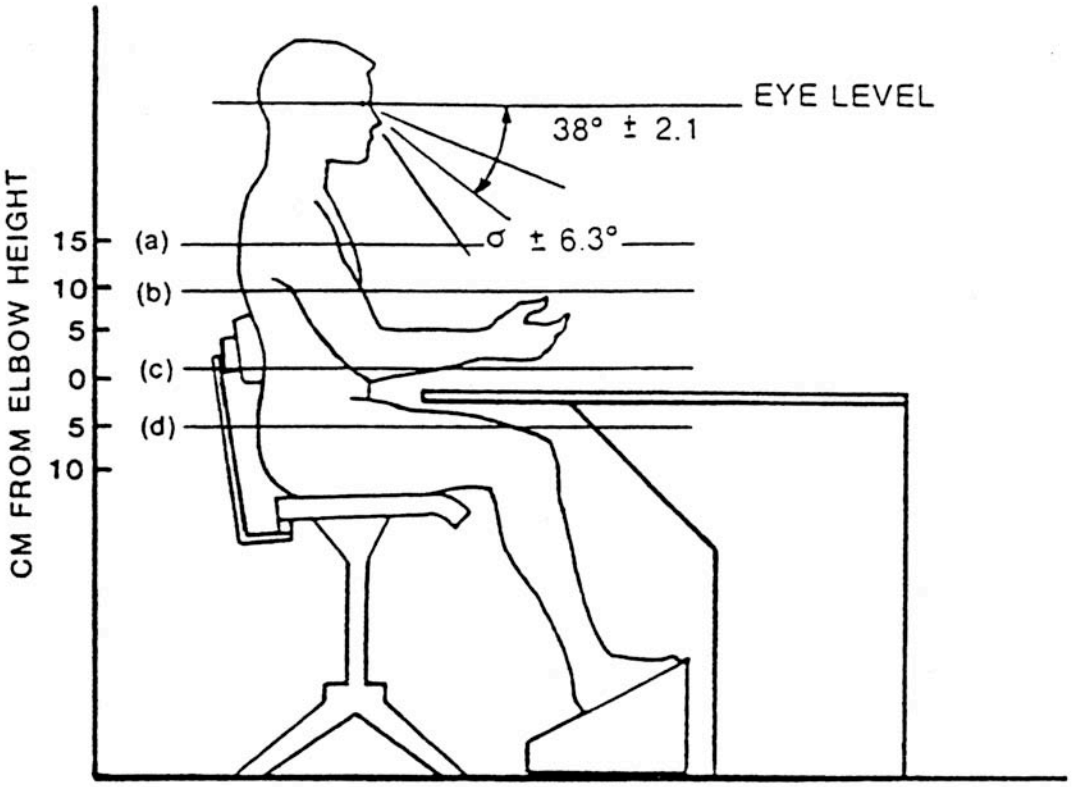
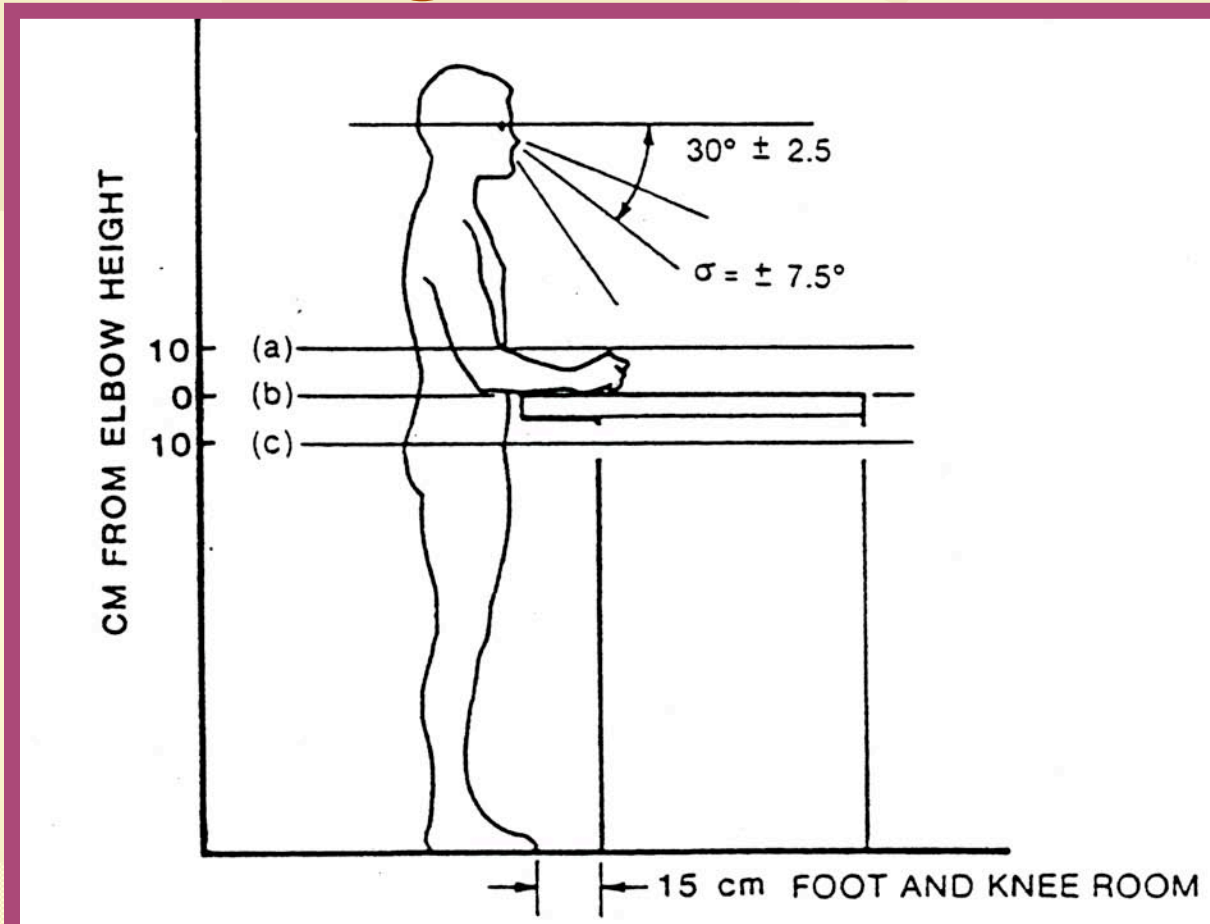
Sitting Task Position



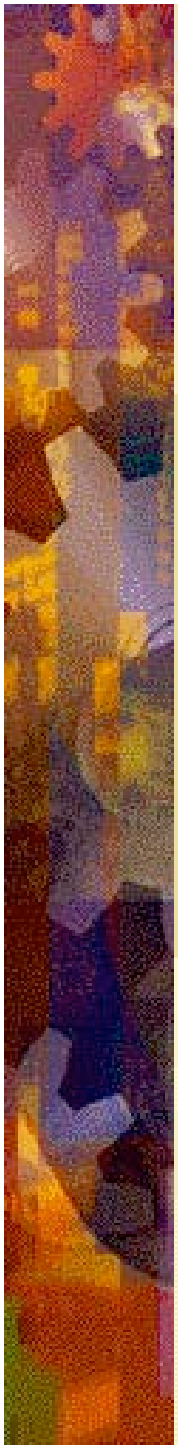
a. For fine work, exacting visual tasks
b. For precision work, e.g., mechanical assembly work
c. For writing or light assembly work
d. Coarse or medium manual work such as packaging

Figure 31a. Design specifications for correct height of work surface for seated operator (adapted from Ayoub, 1973).[4]

Standing Task Position

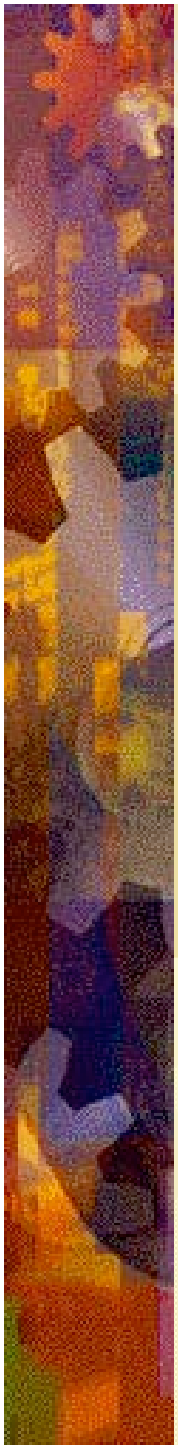


a. For precision work with supported elbows
b. For light assembly work
c. For heavy work



Standing Tasks

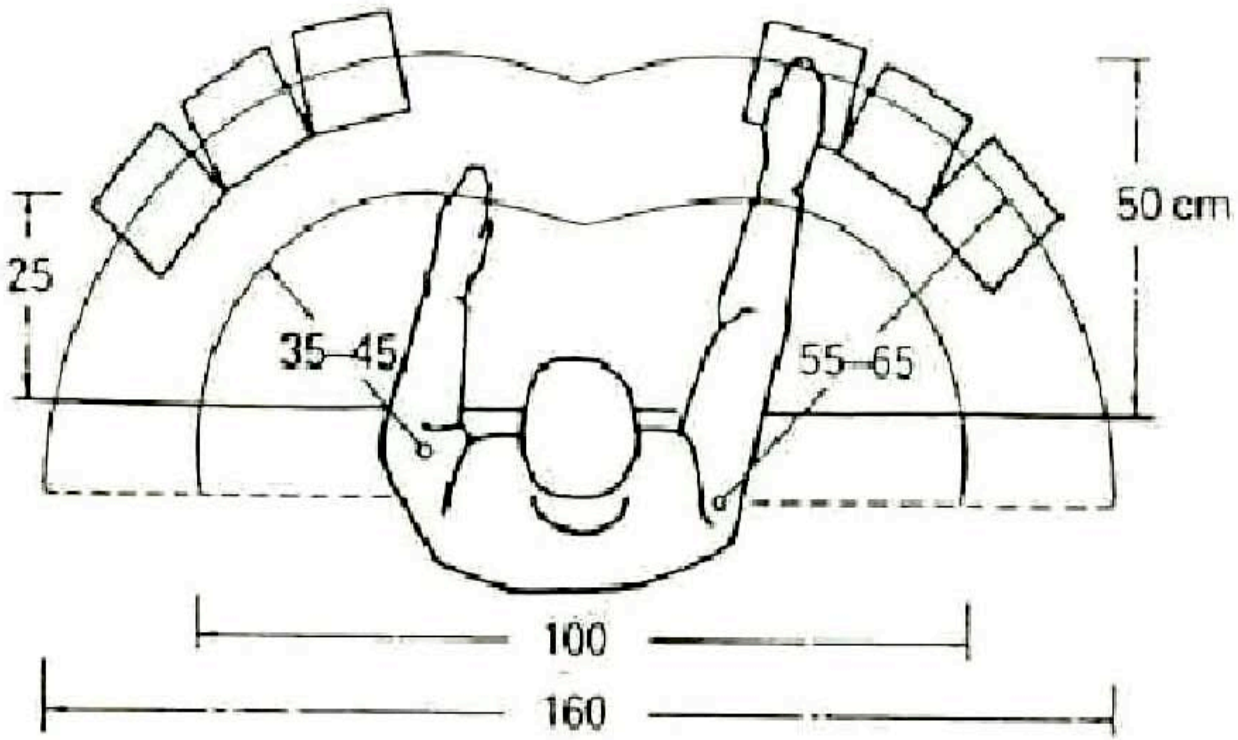
- Good Posture
- Adjust work heights to decrease bending or stooping.
- Use platforms, stools and ladders when working overhead
- Orient workstation so reaching is minimized.
- Rotate tasks: sitting-standing-walking
- Decrease barriers to lifting.
- Lift with two hands

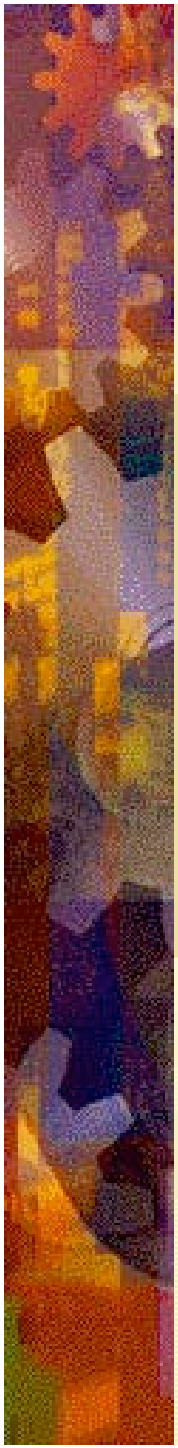


Arm and Hand Position

- Shoulders relaxed
- Elbows almost at right angles or 90 degrees
- Reaching at a height no more than 10” (25.4cm) from work surface
- Reaching at a distance no more than 18” (45.7 cm) with one hand or 15” (38.1 cm) with both hands
- Avoid sideward reaching: place frequently used items directly in front of you

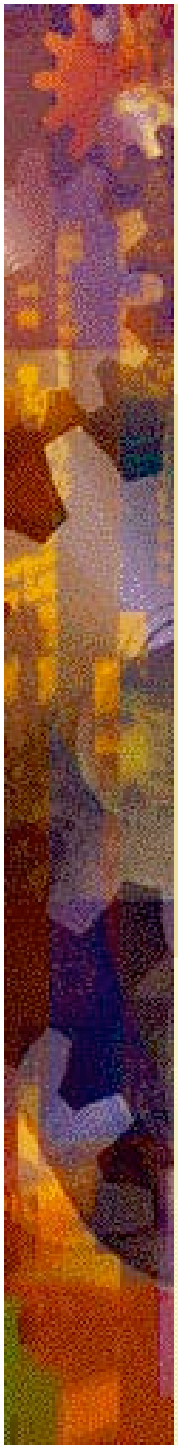
Ideal Arm Reach





Static Postures

- Definition: Static postures are positions that are held for a period of time.
- They are stressful motions because they cause continuous exertion of the same muscles.
- It is important to vary your position when doing any activity.



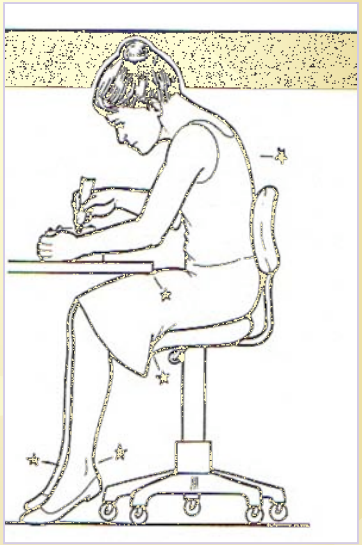
Awkward Postures

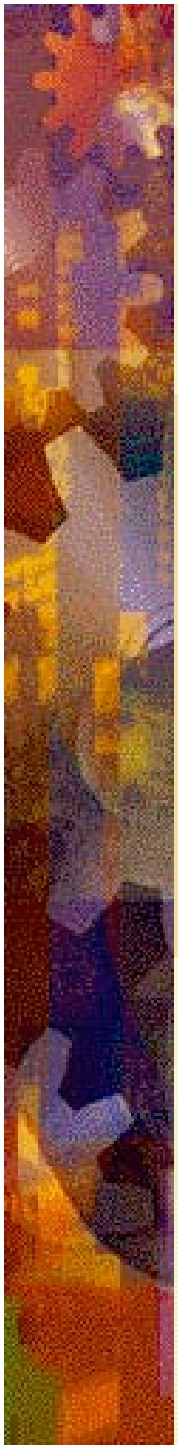
- These are positions or movements that occur when a body puts undue load on muscles and tendons to maintain a position.
- Not natural, non-neutral
- Can potentially cause bones to get out of alignment and cause muscle imbalance
- Can potentially compress nerves, shorten or overstretch tendons and muscles

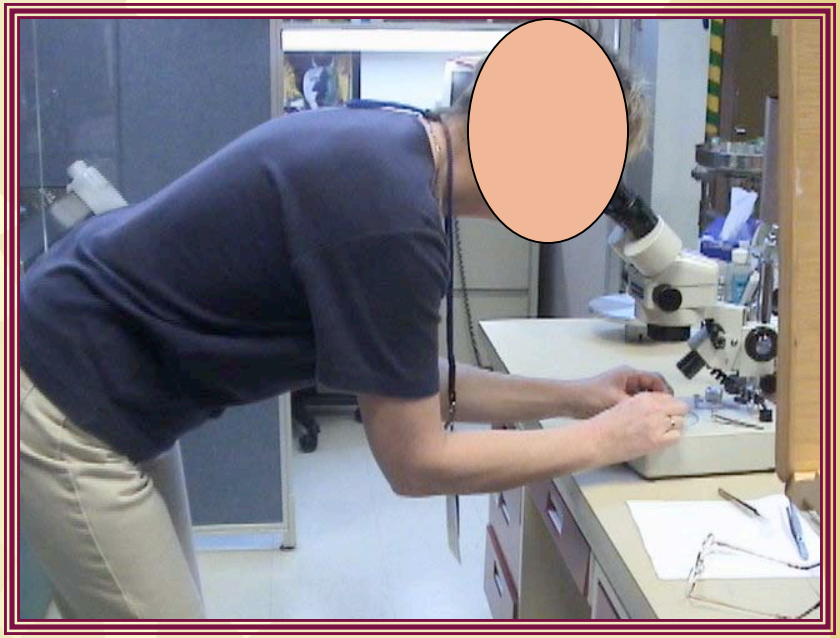
Awkward Postures

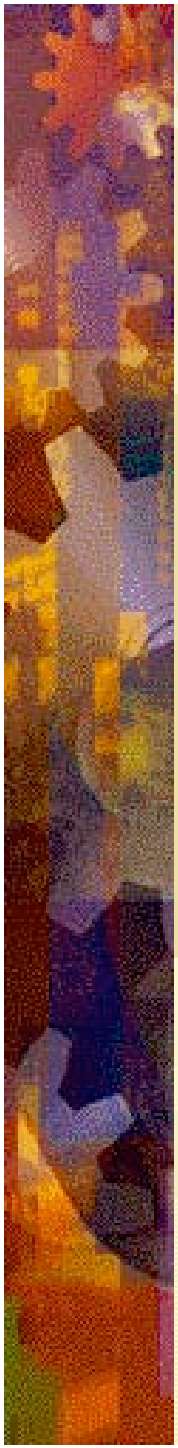
SPINE

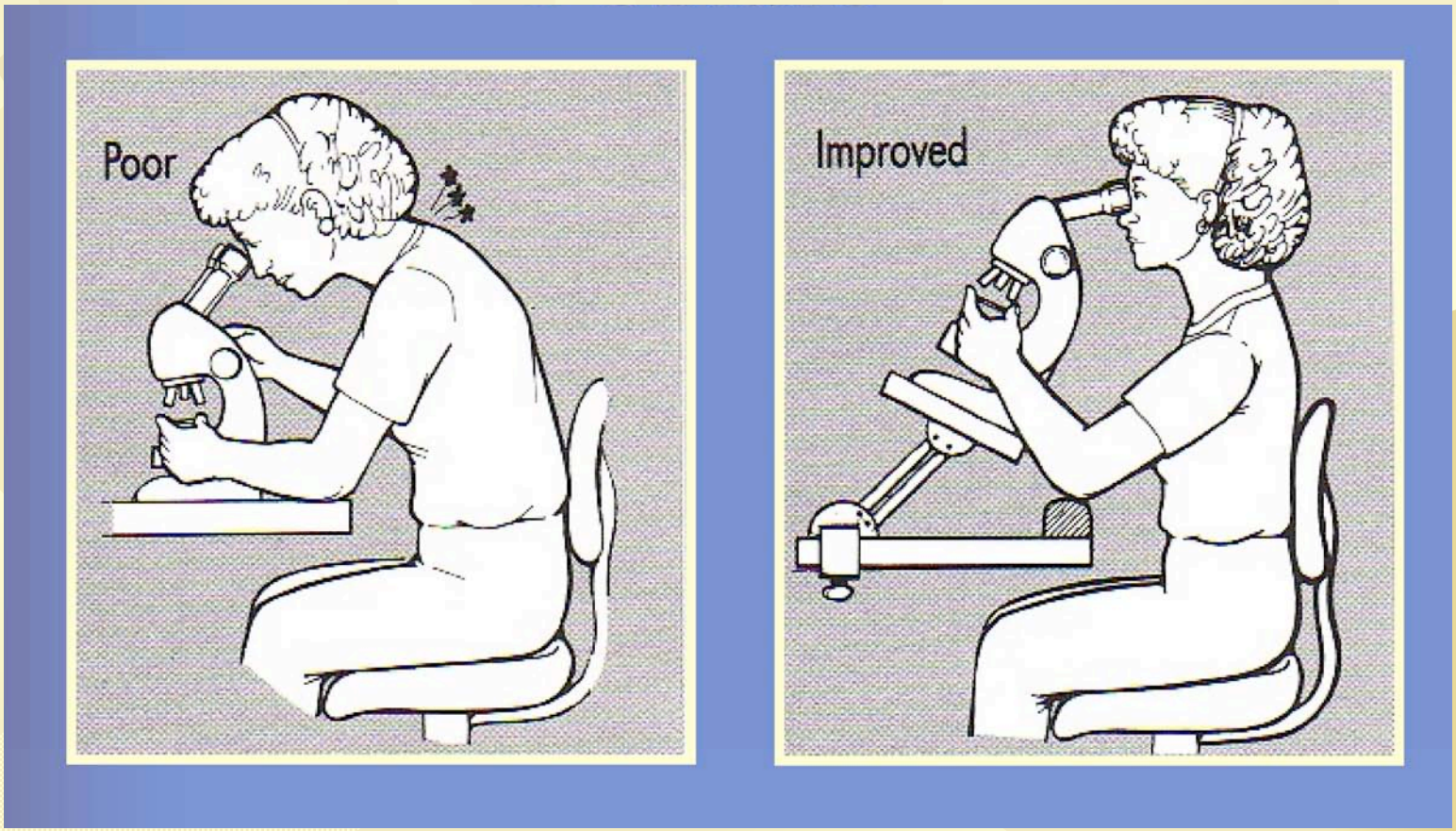
- Forward bend
- Backward bend
- Side bend
- Rotation

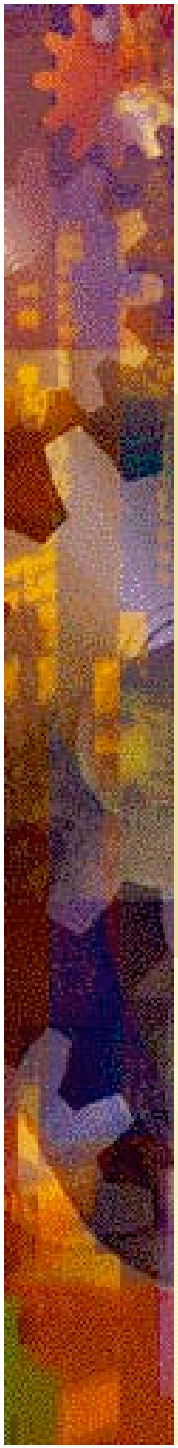








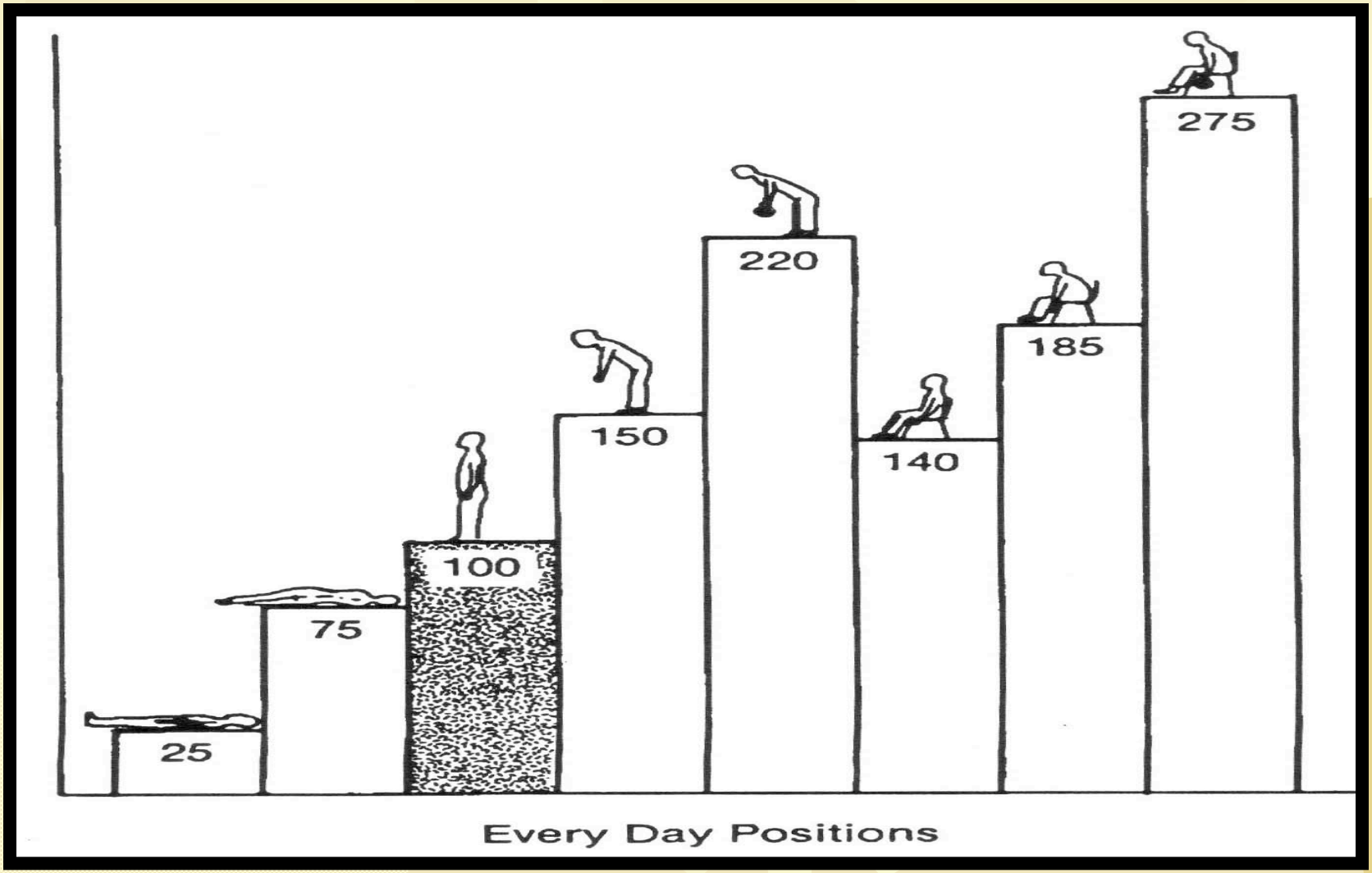

Poor
Improved



Posture and the Back

- Sitting Advantages:
  - Requires less muscle activity and thus delays fatigue
  - Provides more stability for precision and fine motor tasks
  - Enables one to maintain good foot posture during foot pedal operation
- Sitting Disadvantages:
  - Based on spinal compressive forces, it is relatively more stressful than standing

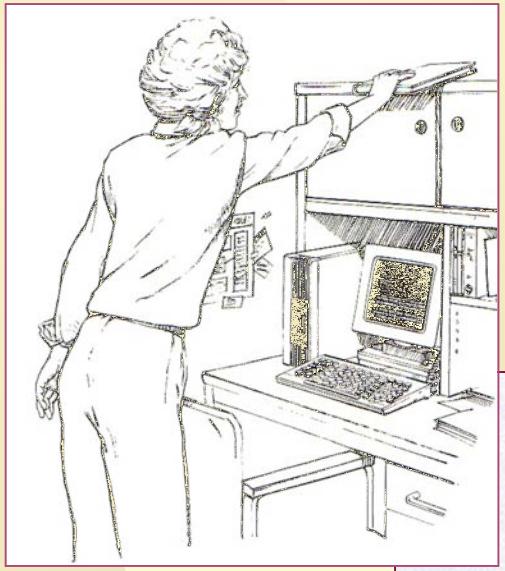
Disc Pressures



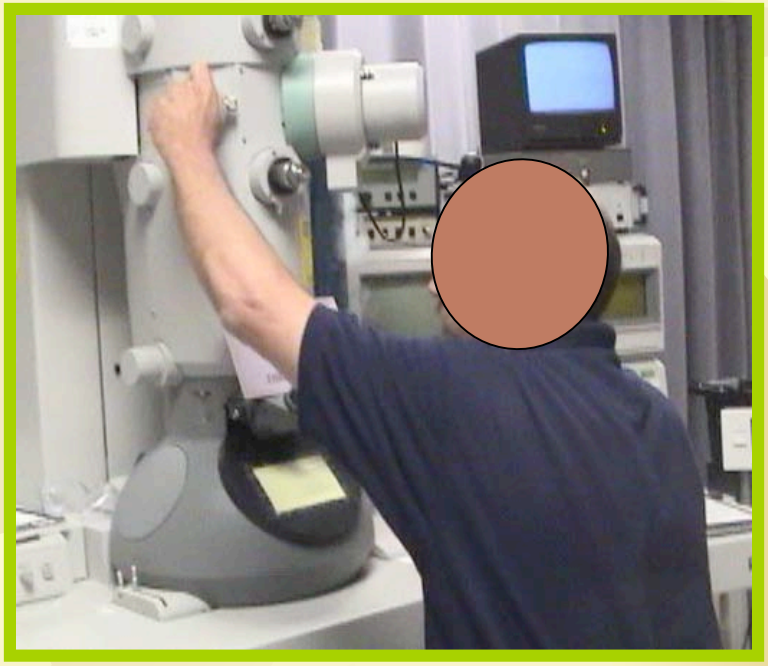
Awkward Postures

UPPER EXTREMITY

- Elbow elevated above midchest
- Reaching behind back
- Extreme elbow bend



Awkward Postures



Awkward Postures

UPPER EXTREMITY

- Extreme forearm rotation in either direction
- Extreme wrist forward bend (flexion)
- Extreme wrist backward bend (extension)
- Extreme wrist deviation

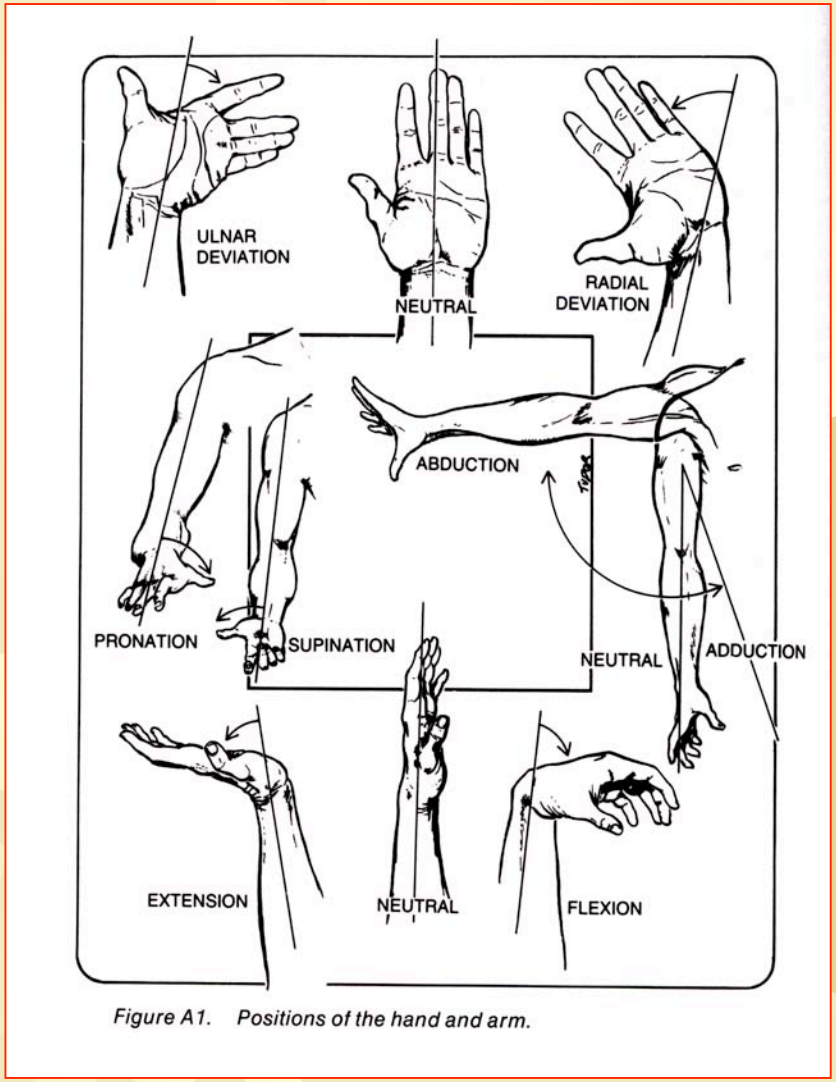
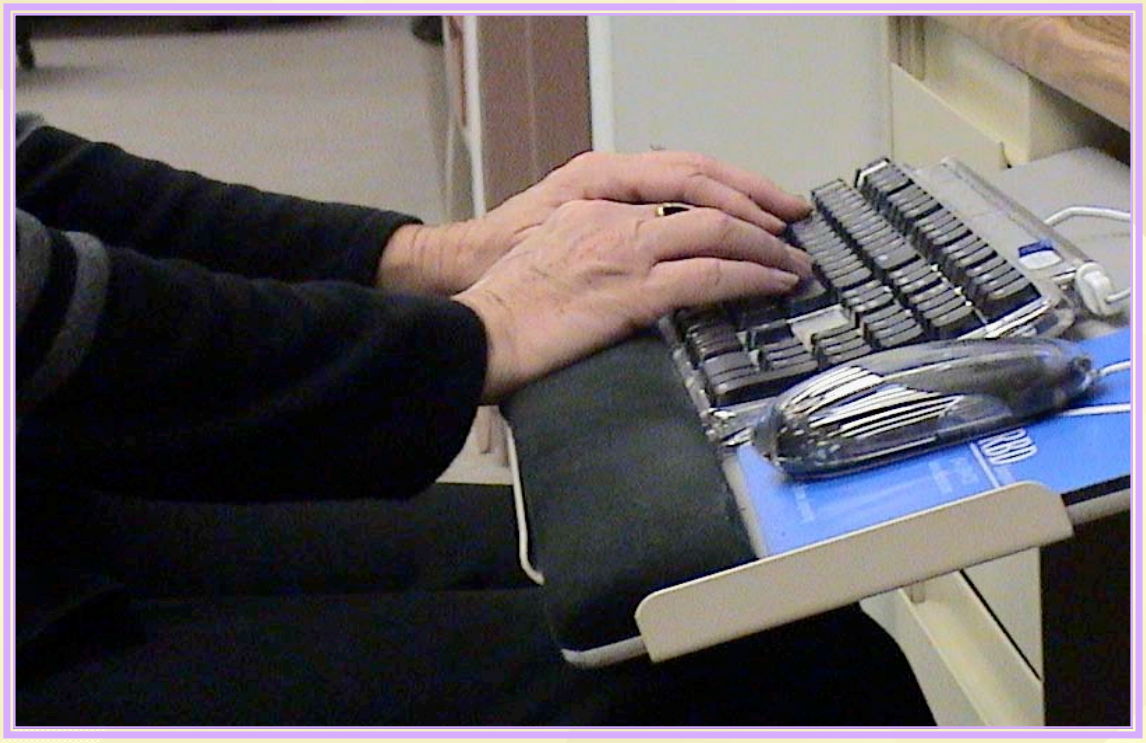


Figure A1. Positions of the hand and arm.

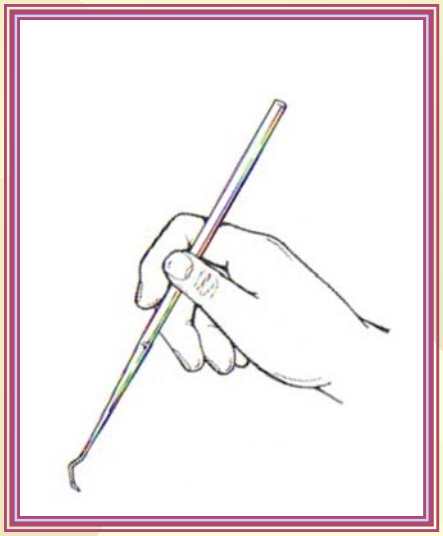
Awkward Postures

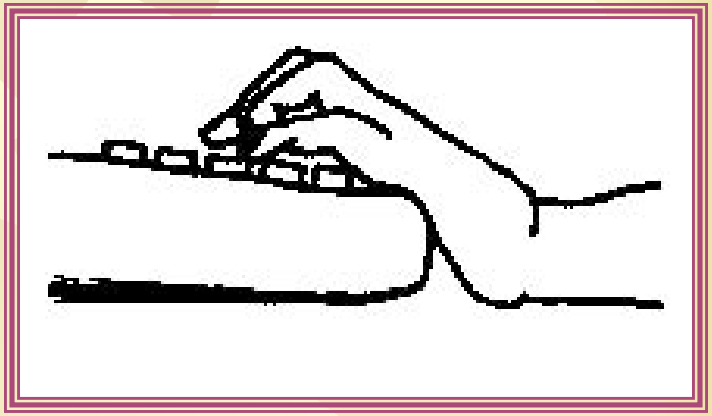


Awkward Postures

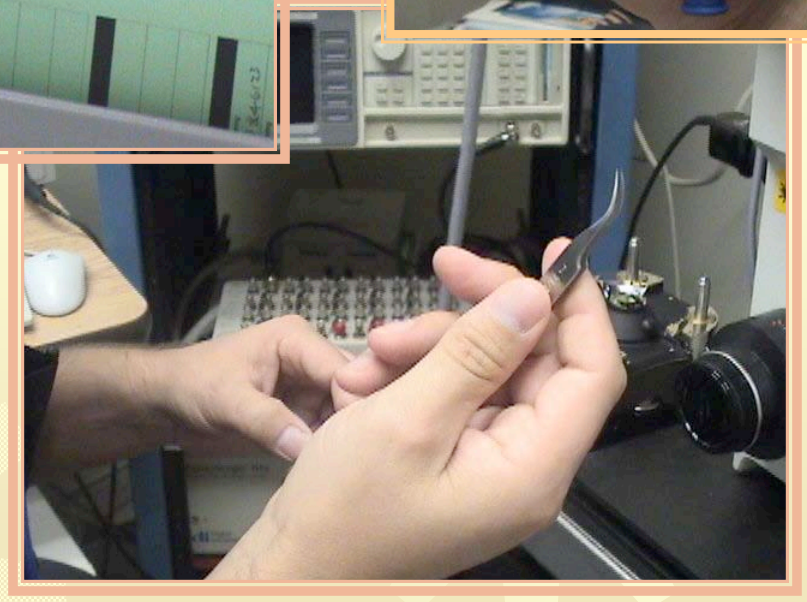
UPPER EXTREMITY

- Pinching or pressing with tips of the fingers
- Contact stress



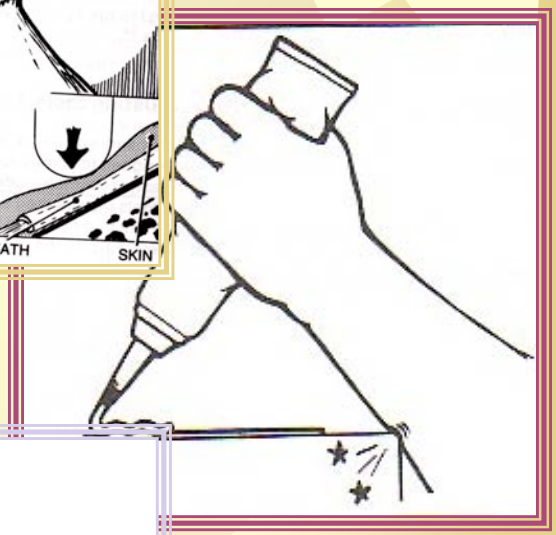


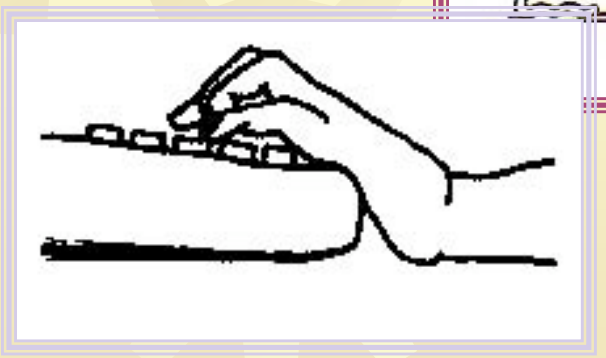
Pinch Grip

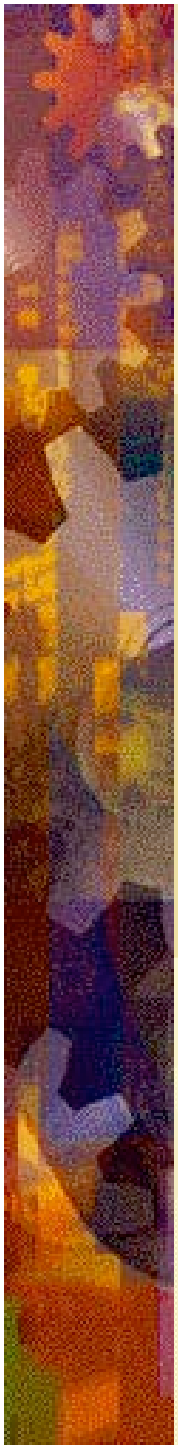


Contact Stress

- Contact stress is produced when pressure is concentrated to a small area, resulting in forces transmitted through the skin to underlying tendons and nerves.
- Contact stress increases when the contact area decreases.



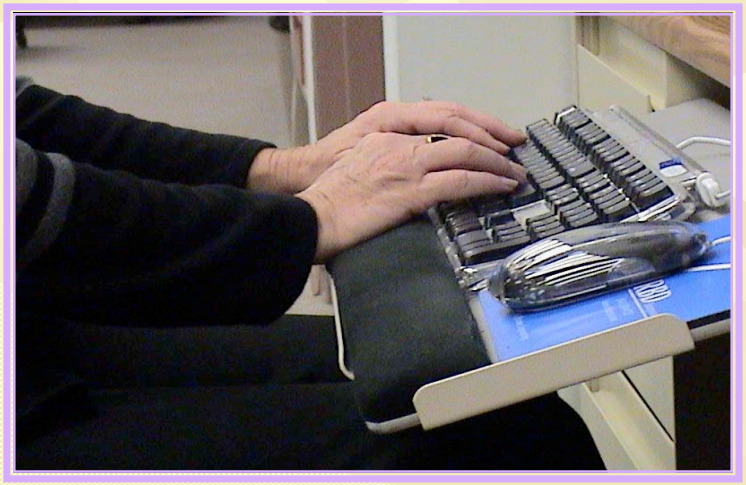


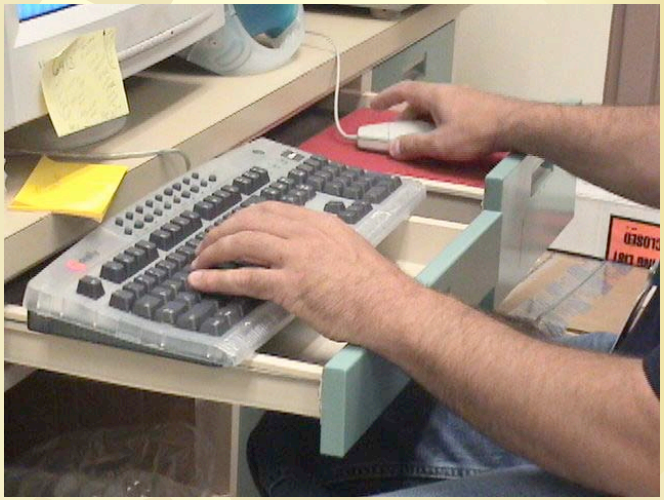


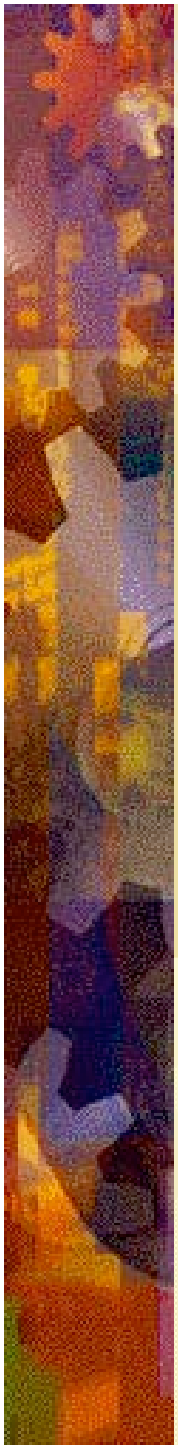
Sources of Contact Stress

- Pressure from poor tool handles
- Pinch grip on pen or pencil
- Pressure from sharp table edge
- Leaning on elbow or forearm on an arm rest or hard surface
- Compressing back of thigh against seatpan
- Compressing top of the thigh against low table or desk drawer
- Kneeling on floor

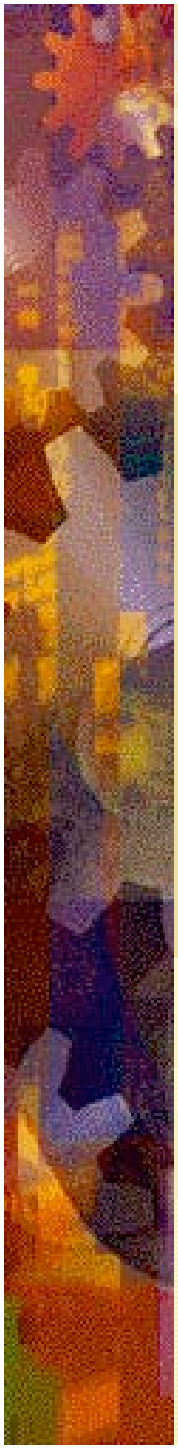
Contact Stress





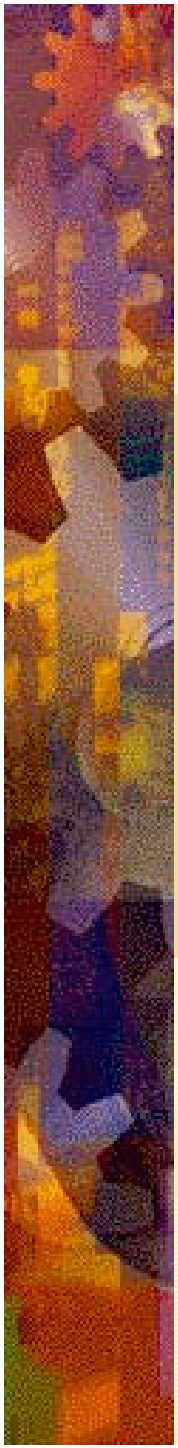



DEAN
OSP's



Other Ergonomic Issues

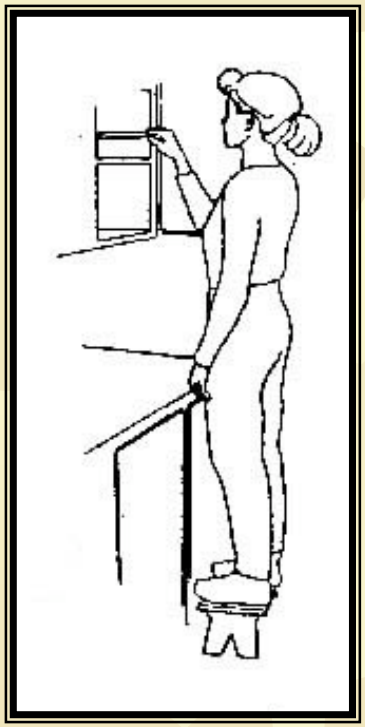
- Eye fatigue
- Flooring – lower body fatigue, stability during material handling. Usually applies to prolonged standing activities
- Noise – decreases ability to concentrate, interferes with communication
- Room Temperature – circulation, comfort issues

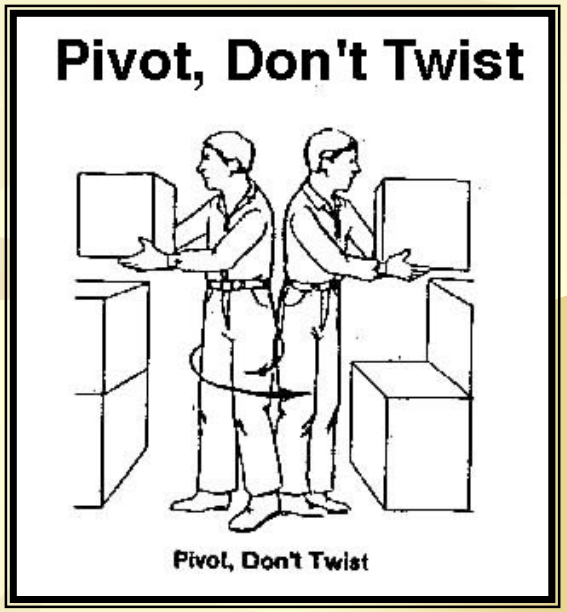


Corrective Actions

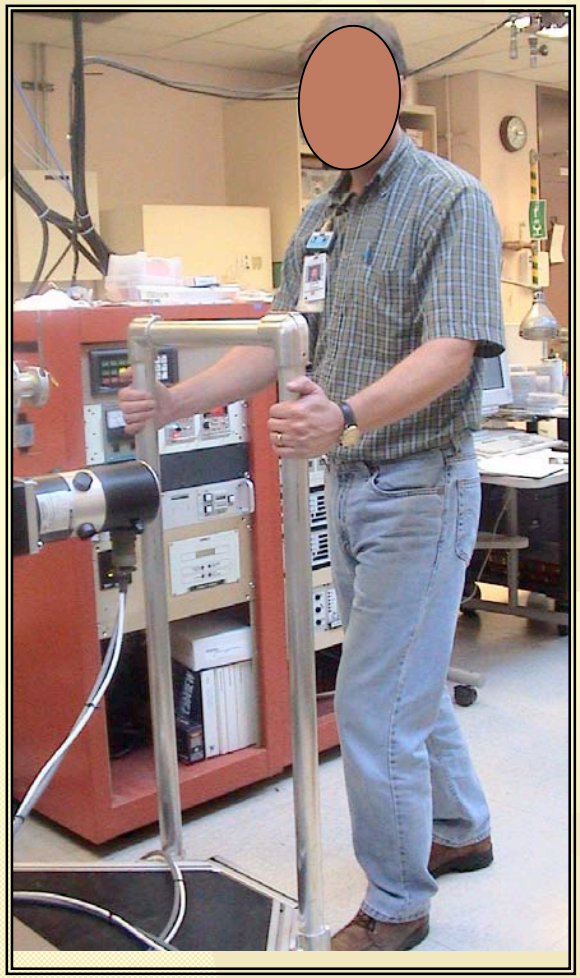
Good Posture

Good Body Mechanics





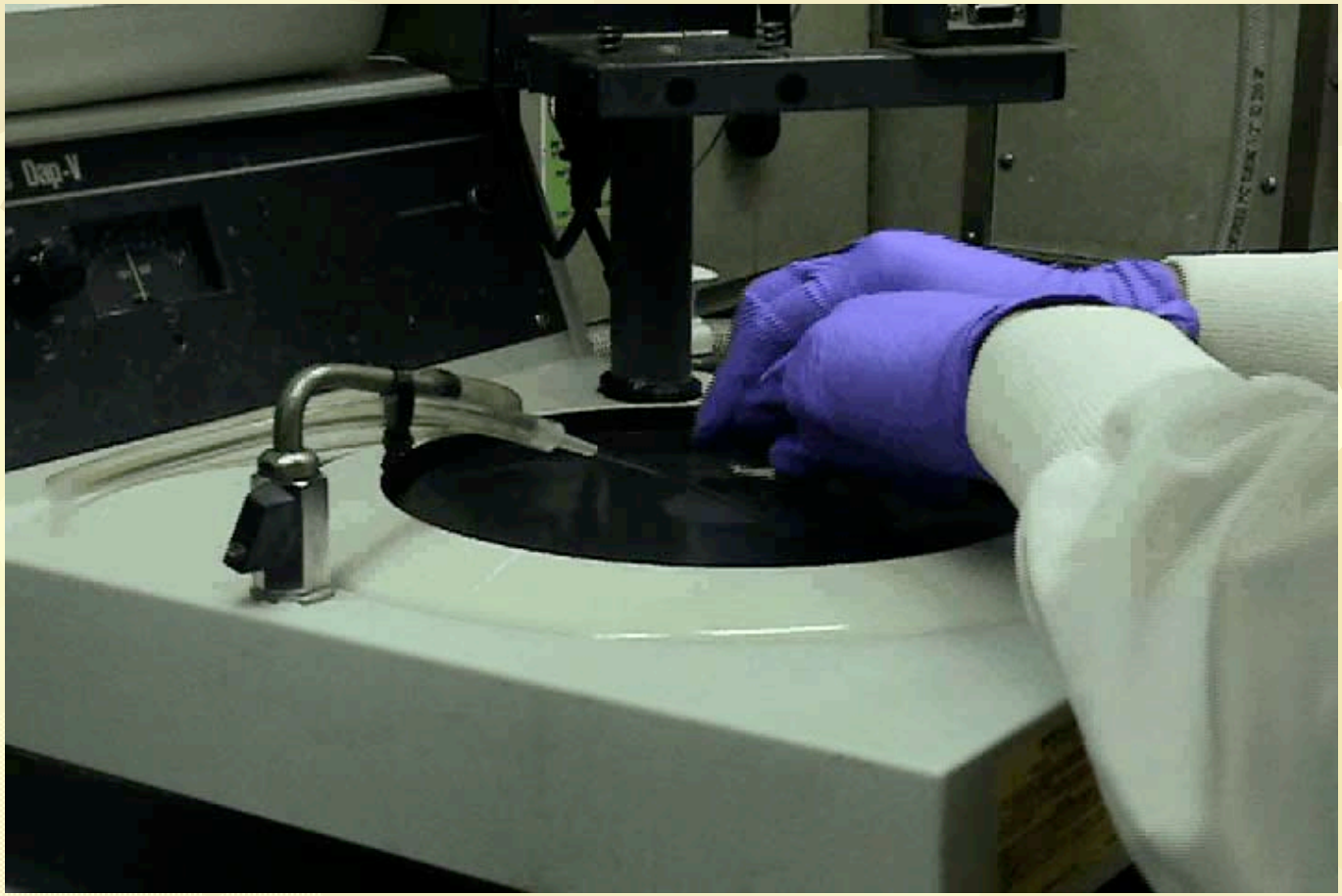
Good Body Mechanics



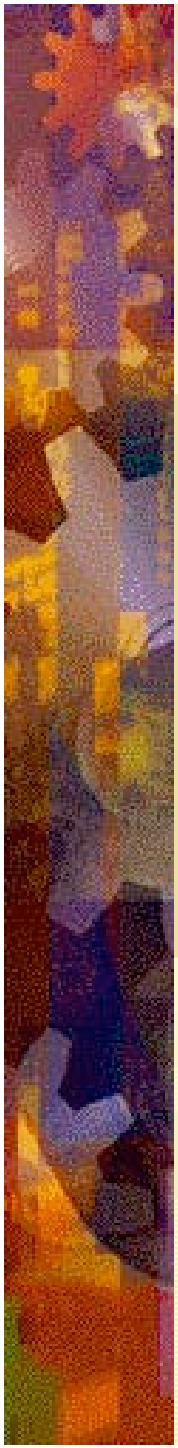
Stride stand with push/pull

Good Body Mechanics

Good Body Mechanics



Use both hands when possible

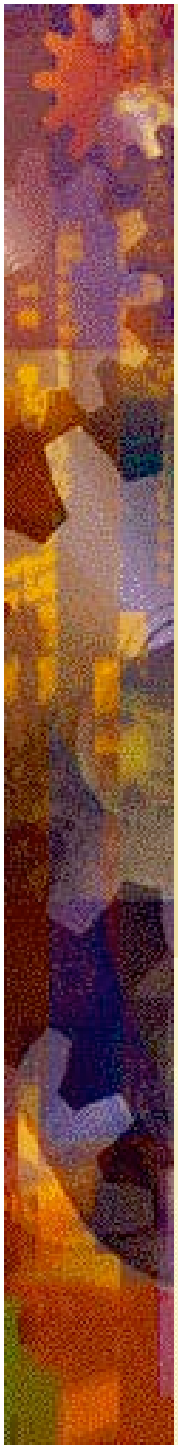


Chair

- Height: Feet flat on floor. Knees almost at the same height as or lower than hips
- Seat: correct size, 2” clearance between seat and back of knees
- Backrest: Adequate lumbar support
- Armrests: Provide support for upper arms and shoulders
- Should roll easily

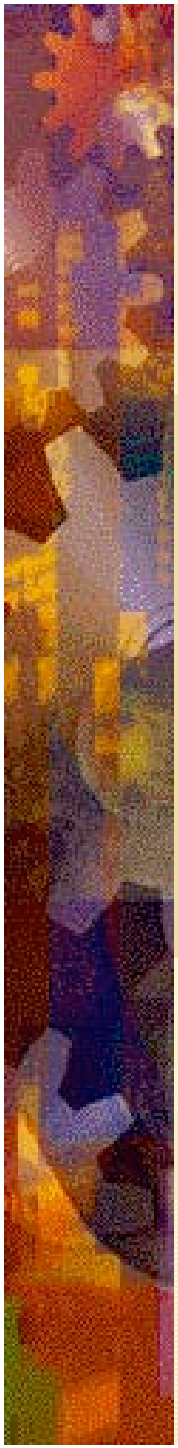
Keyboard and Mouse

- Keyboard at belly-button height
- Tilt flat or negatively
- Wrists in line with forearms
- Wrists free from rough or sharp edges
- Mouse as close to and at the same level as the keyboard
- Elbows below shoulders when typing



Monitor

- Screen in line with keyboard and user
- Distance: About arm's length
- Height: Line of sight rests on upper third of the screen
- Free from glare
- Head position in neutral
- Vision – eye glasses, eye dominance



How to lift properly

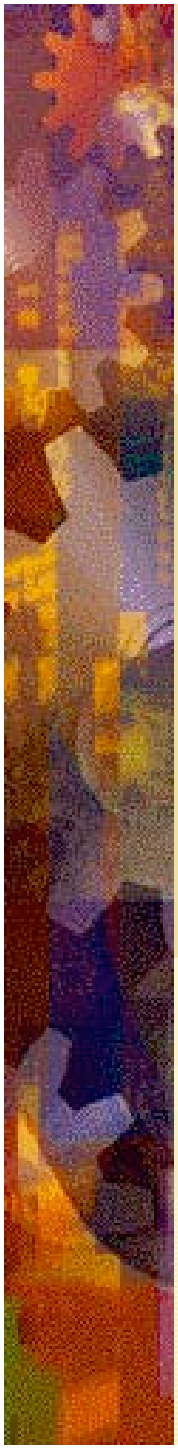
1. Stand with your feet shoulder-width apart, toes pointing out.

2. Bend your knees, as you lower your body, keeping the natural curves of your back. Don't bend at the waist.

3. Keep shoulders back. Tighten your abdominal muscles.

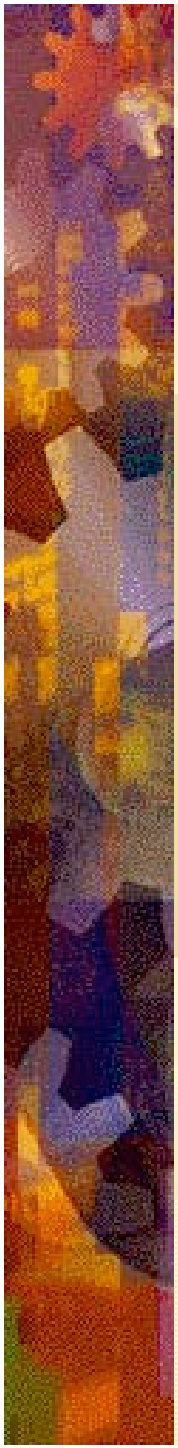
4. Tuck your buttocks under as you come back up. Lift with your legs.

5. Keep the load close to your body.



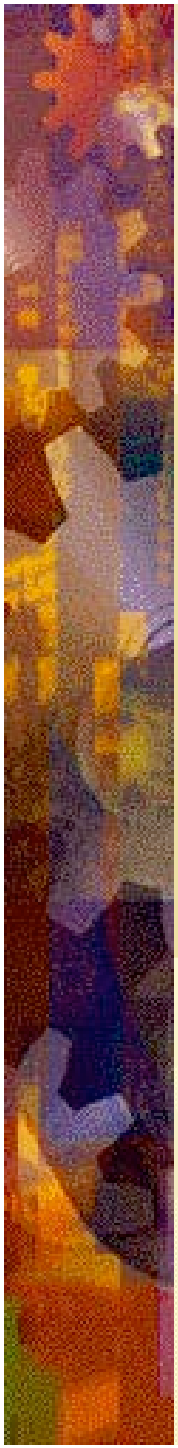
Eye Fatigue

- Have an adequate light source – not too bright nor too dim.
- Avoid or prevent glare – overhead light, open windows, reflection from reference materials.
- Keep monitor screen clean. Adjust contrast.
- Take short breaks to rest your eyes by focusing far away or shutting them to change focal length.
- Get eye exams regularly.
- Remember: Line of sight is 30 degrees from horizontal.



Solutions for Prolonged Standing Tasks

- Reduce leg fatigue:
  1. Install anti-fatigue mats – choose well & should be appropriate for work environment
  2. Use anti-fatigue soles
  3. Minimize periods of static work
  4. Use footrest
  5. Incorporate periods of seated activity



Solutions For:

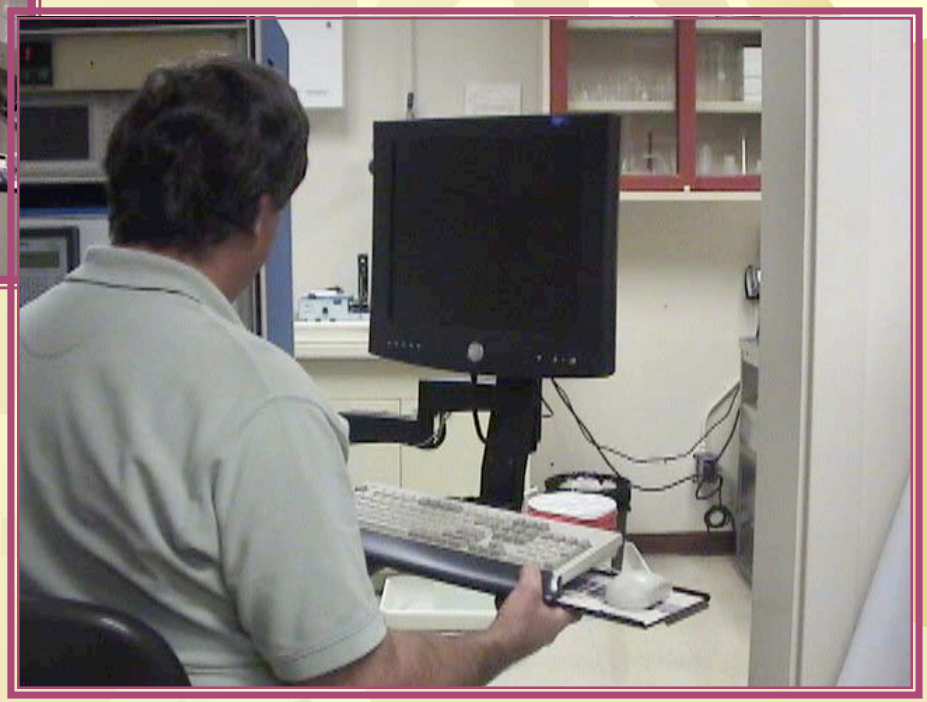
Temperature

- Dress appropriately
- Install heaters if safe
- Wear protective equipment when handling items of extreme temperatures

Noise

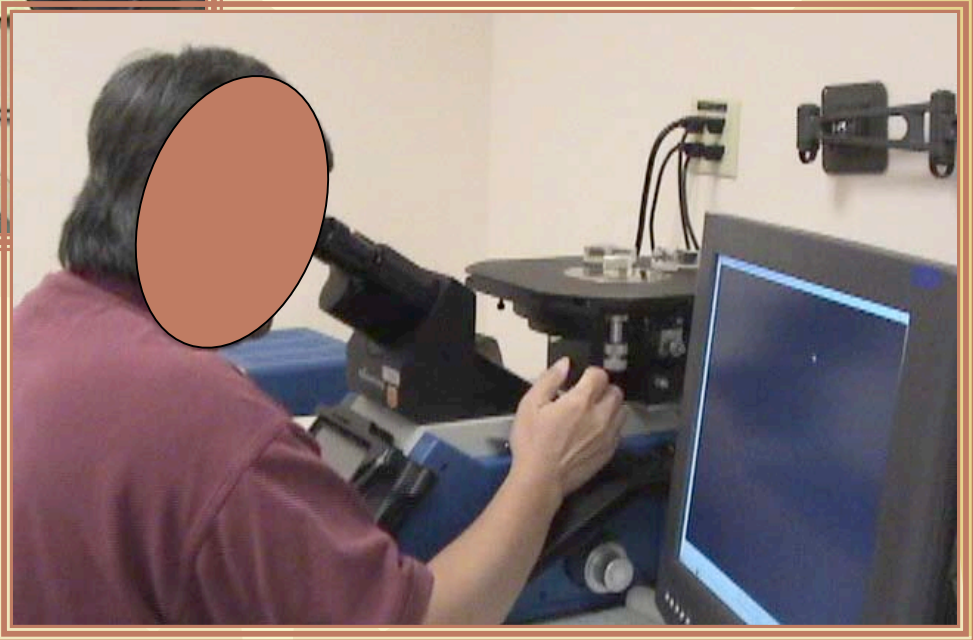
- Reduce the level
- Use barriers to reduce noise transmission though air or structures
- Provide hearing protection
- If unable to do much to alter noise levels, reduce amount of time spent in these areas

Workplace Organization

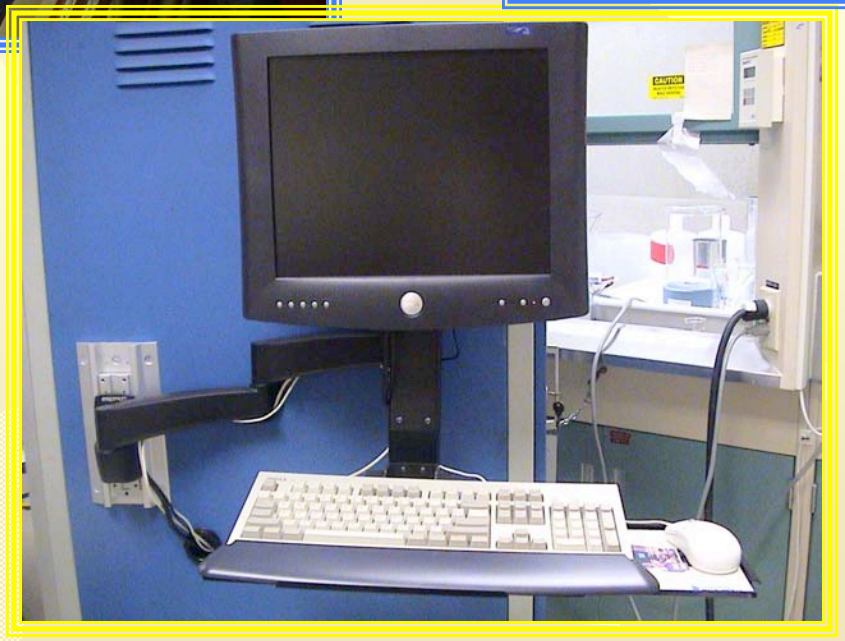


Workplace Organization

Keep things within easy reach.



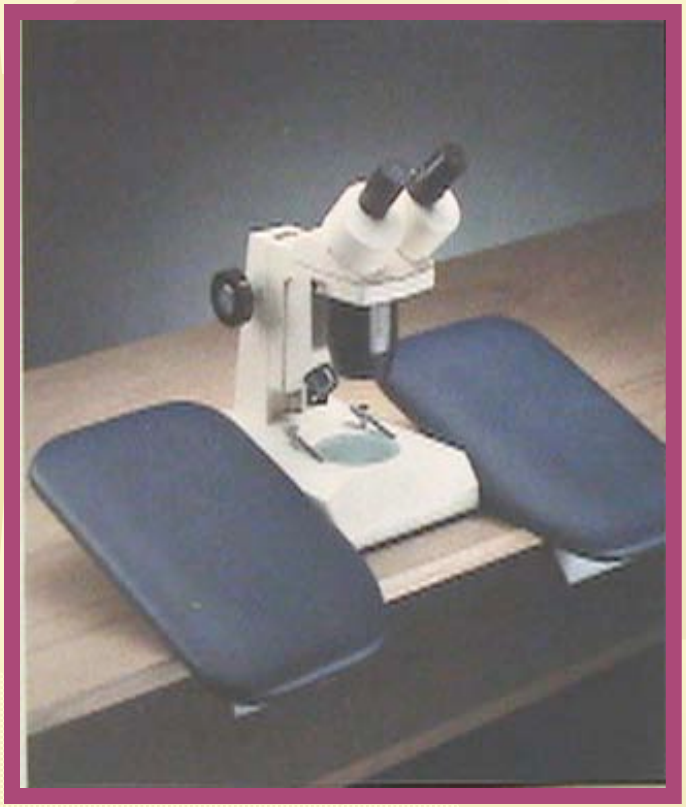
Adaptive Tools and Equipment

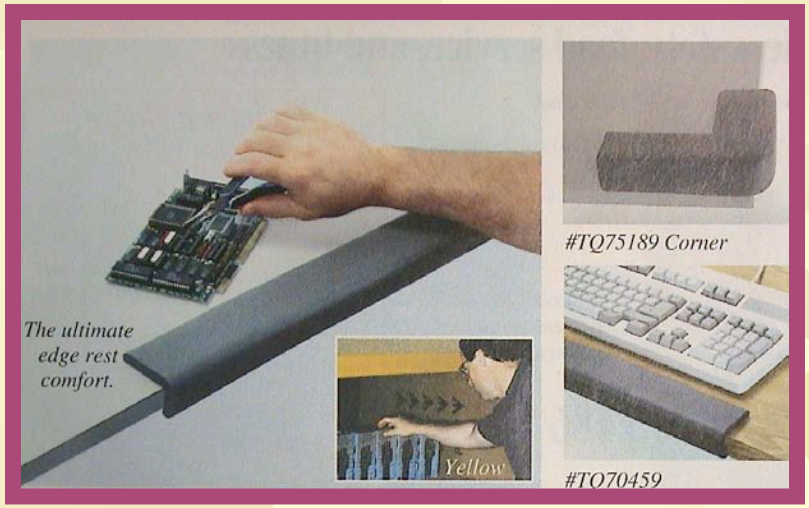


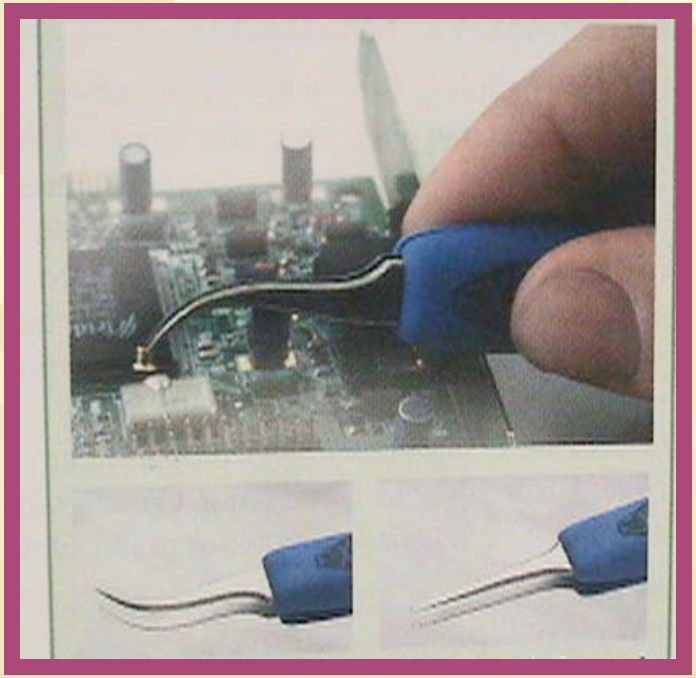
Adaptive Tools and Equipment

Use sturdy & stable ladders and step stools

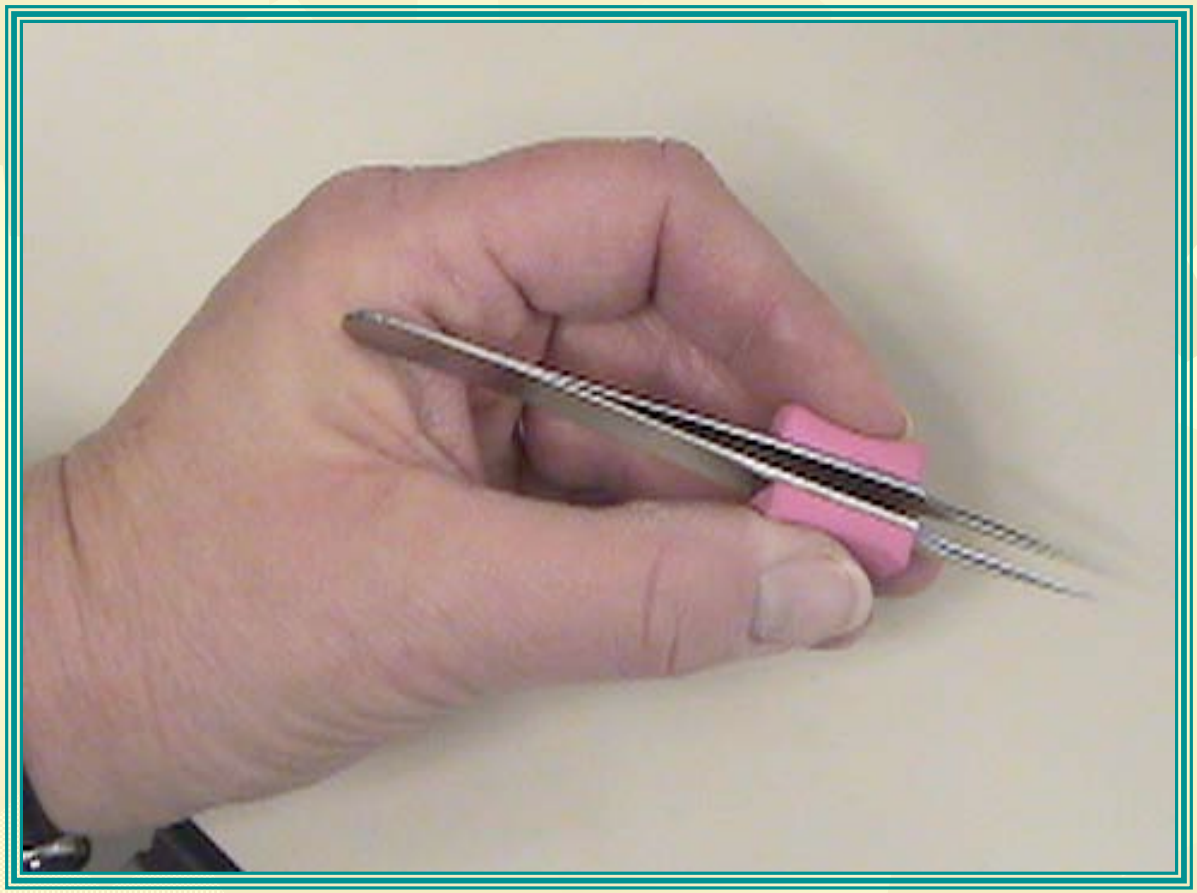
Adaptive Tools



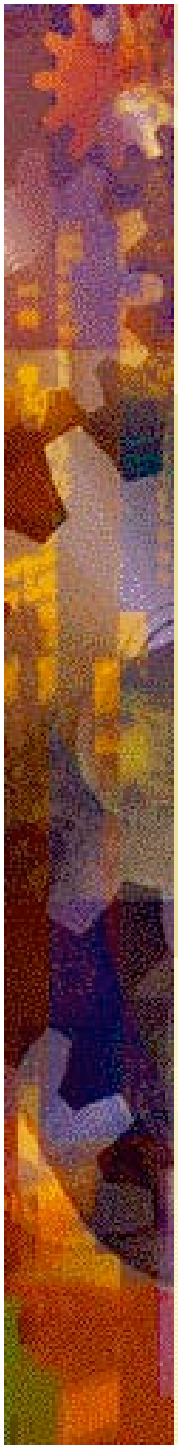




Adaptive Tools



Contact Jessee Welch for information

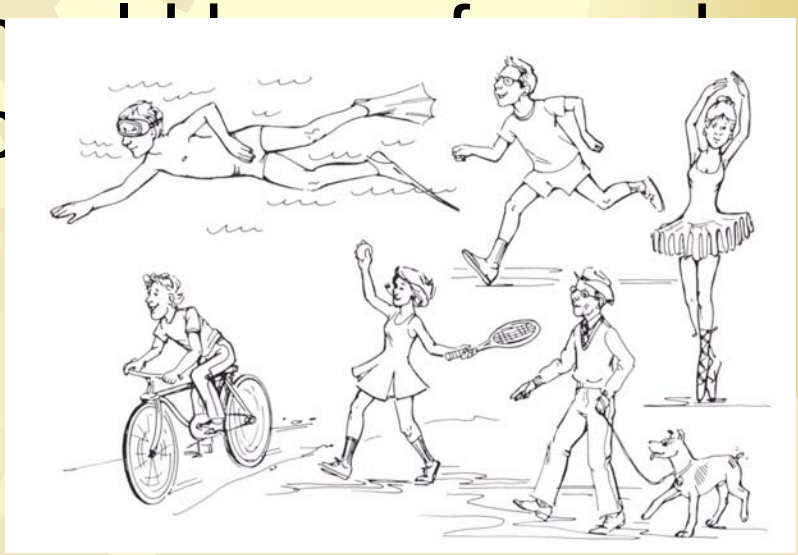


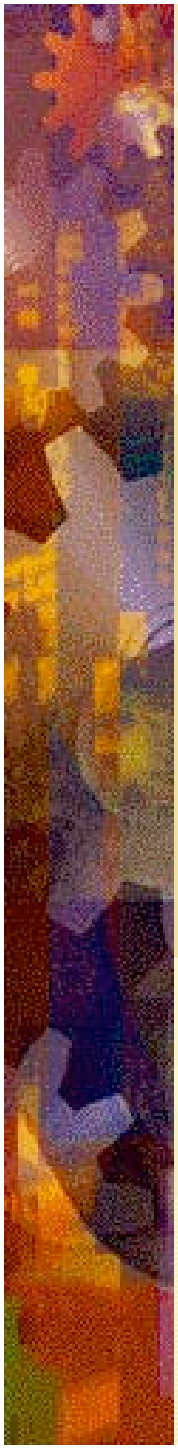
Types of Exercise

- Aerobic Exercise
  - Running, walking, bicycling, swimming.
- Strengthening Exercise
  - Weight lifting, push ups, pull ups, isometrics
- Stretching Exercise
  - Calf stretches, forearm stretches, chest stretches, low back stretches

Aerobic Exercise

- **Cardiovascular Benefit**
  - Normalizes blood pressure
  - Strengthens heart
  - Increases overall fitness/endurance
  - Reduces stress
- Aerobic exercises sh
  at least 20 minutes p
  day

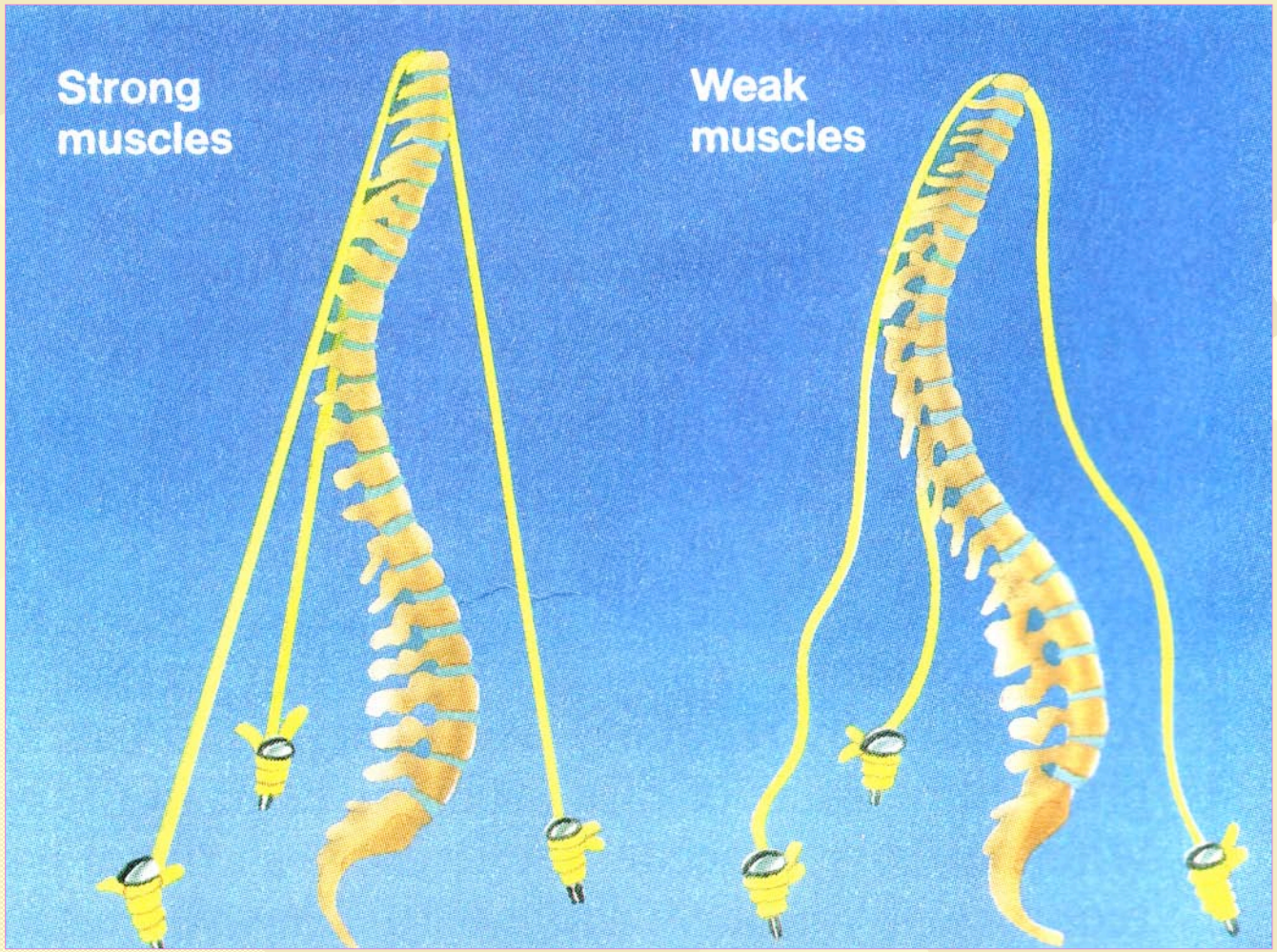


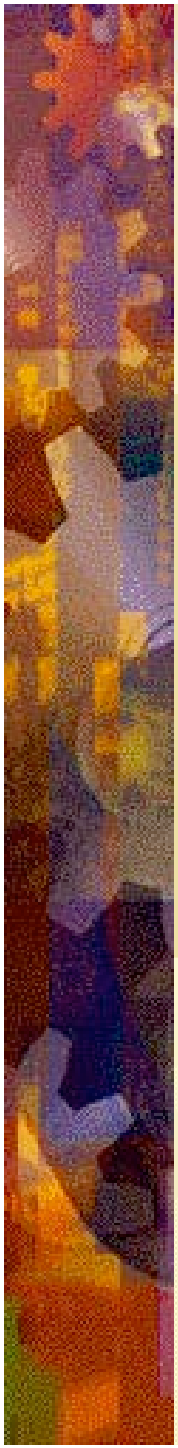


Strengthening Exercise

- **Benefit**
  - Increases strength for work-related tasks.
  - Decreases fatigue.
  - Increases bone density.
- Should be performed every other day to allow muscle rebuilding without breakdown.

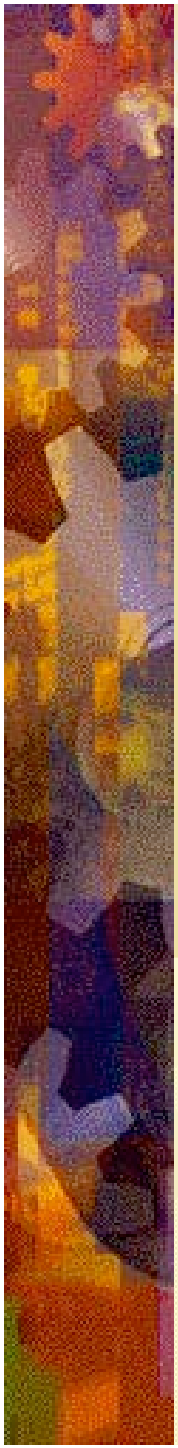
Importance of Good Muscle Support





Stretching Exercises

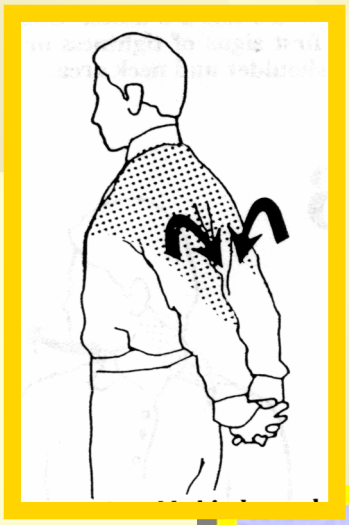
- **Benefit**
  - Increases flexibility
  - Reduces muscle spasm
  - Increases circulation
  - Decreases pain and fatigue
- Stretching exercises should be performed often throughout day, during breaks, or intermittently with job tasks

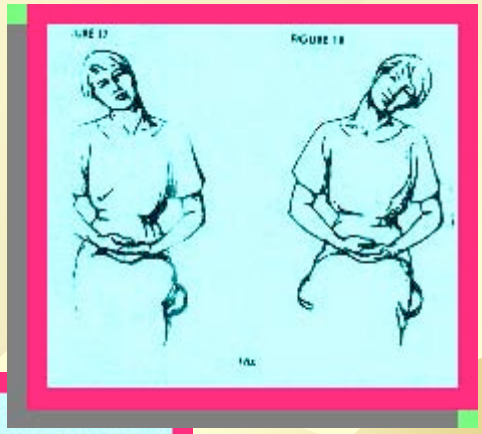


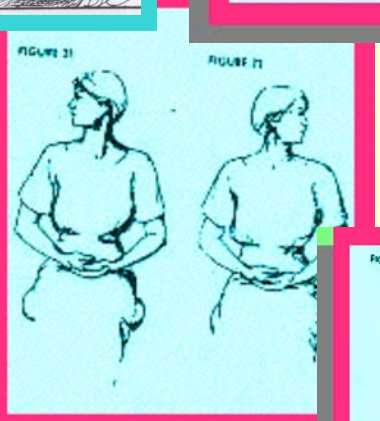
Proper Way to Stretch

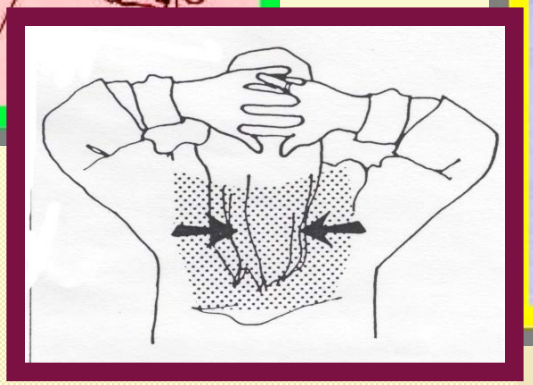
- Do slowly and hold for 10 or more seconds.
- Do not bounce or “pump”.
- Stretch within your comfortable limit. If it hurts, don’t do it!
- Do a minimum of 2 repetitions every hour.
- Train muscles, don’t strain them.
- If under medical care, check with your doctor first.

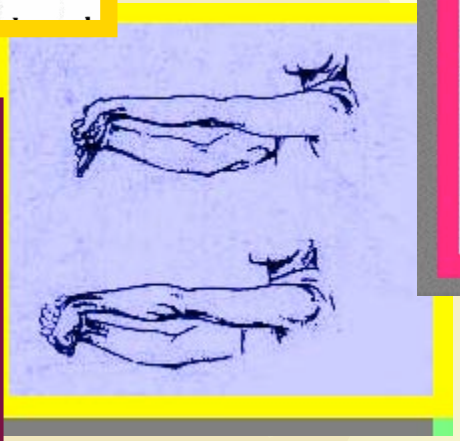
Upper Body Stretches



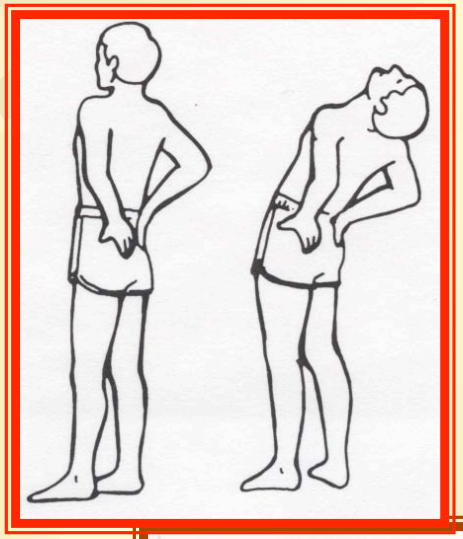


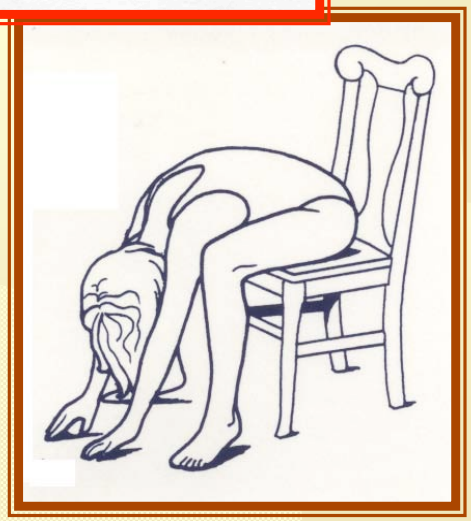


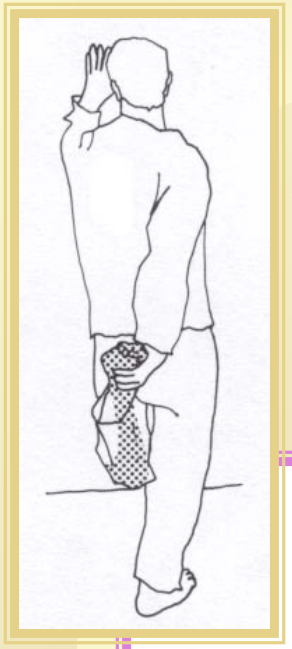


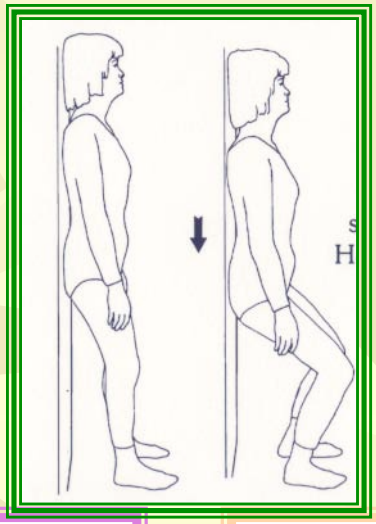


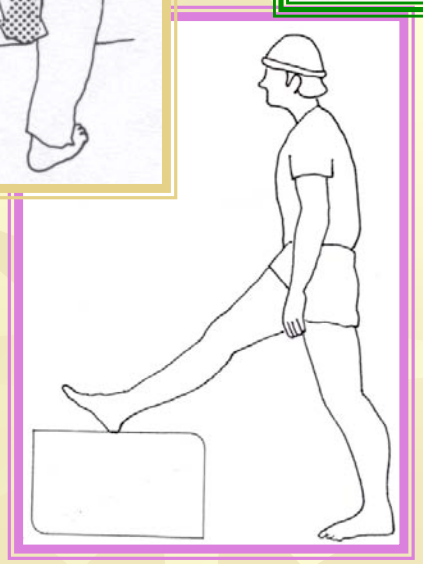
Lower Body Stretches

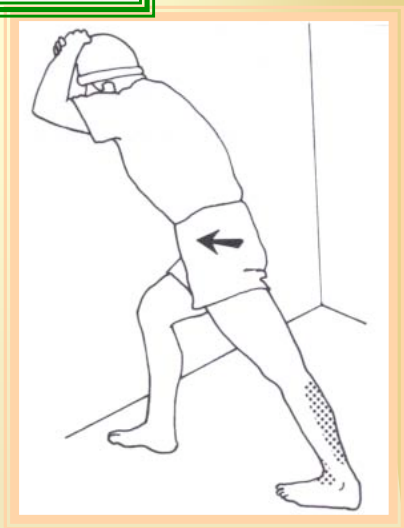




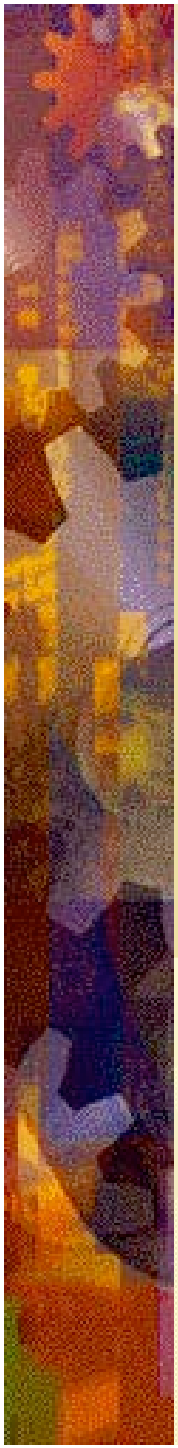








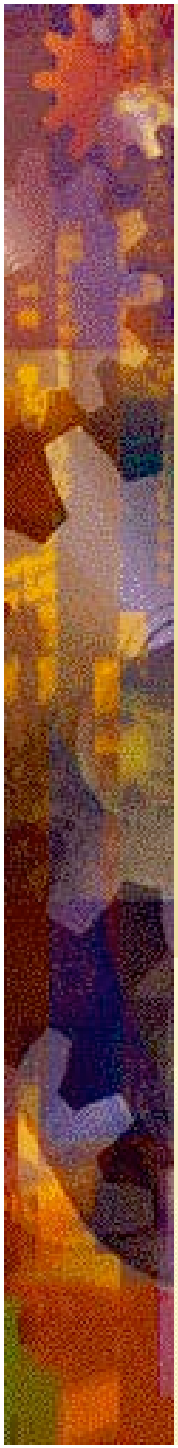
Ergonomic Improvement Process



Corrective Actions

- Identify & reduce risk factors. Let supervisor know if you are in discomfort.
- Practice good posture & proper body mechanics. Change positions frequently
- Practice good work behavior & habits. Learn how to make necessary adjustments
- Improve workplace organization. Keep everything within easy reach, remove clutter, provide clearance & access
- Use available adaptive tools and equipment
- Exercise and Stretch!

Be Proactive!



Thank You.

You've been a great audience!